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Advertising Index, Last Page

"NATIONAL" Preparedness

A gentleman once said to a representative of the National Tube Company—"What can you say about pipe; it's simply a bunch of air with a piece of steel around it." An immediate answer was not available, but shortly after this a book, **"The Age of Power"**, written by an engineer, came to the attention of the person addressed—and the theme was this: There is less difference than is usually supposed between the 20th Century and, say, the 10th or 12th or any other previous Century. There is nothing new under the sun. There is a difference, however, in the externals and this difference can be reduced to some phase of the **Generation, Transmission and Use of Power** and the Ramifications **thereof.**

Inasmuch as pipe is an essential part of power, this would seem to be an interesting idea.

An attempt was made to elaborate the theme in prose, without much success. The matter was then put into the hands of Berton Braley (the poet of industry) and the following poem is the result. The whole thought of the poem is contained in the next to the last line—"Framework of civilization is wrought of it." It should be noted that this poem has particular reference to **daily living** preparedness, and not in any way to **military** preparedness.

ARE we prepared? Yes, for every emergency
Every contingency under the skies;
Ready for cases of danger and urgency,
Ready for commonplace needs that arise;
Fully prepared for our labor or pleasuring,
Armored and armed for the course to be fared,
Fit for each chance that the mind can be measuring—
"NATIONAL" Tubing has made us prepared.

"NATIONAL" tubing prepares us for traveling
Carries the steam that is driving the train,
Keeps us in ease as the miles are unraveling
Over the mountains and over the plain;
"NATIONAL" Tubing brings water of purity
Into our homes from the far-away hills;
Stands at our windows, a guard of security;
Brings us our gas—and the drudgery kills!

WHY, from the time we are infants in carriages
(Go-carts of "NATIONAL" Tube, as you know),
Up through our childhood, our loves and our marriages,
On till our tresses are covered with snow,
"NATIONAL" Tubing's assisting and aiding us;
Keeping us warm when the icy winds blare,
Holding up awnings, in summer, for shading us,
—"NATIONAL" Tubing has helped us prepare.

CASING for oil wells, shafts for machinery,
Pipes for the drills digging copper and gold,
Poles for the power wires looping the scenery,
Frames for the plows that are turning the mold;
"NATIONAL" Tube, in a thousand varieties,
Serves for ten thousand requirements of life,
Whether in places where comfort and quiet is
Or in the midst of the heat and the strife.

SO when we speak of preparedness "NATIONAL",
"NATIONAL" Tubing is there—it's a pipe!
Fully prepared for the needs that are rational,
Builded for service of many a type;
Dreamers have dreamed and the thinkers have thought of it,
Till every nation its service has shared;
Framework of civilization is wrought of it,
"NATIONAL" Tubing has made us prepared!

BY BERTON BRALEY

It pays to be NATIONAL

"NATIONAL" Pipe is made by

NATIONAL TUBE COMPANY

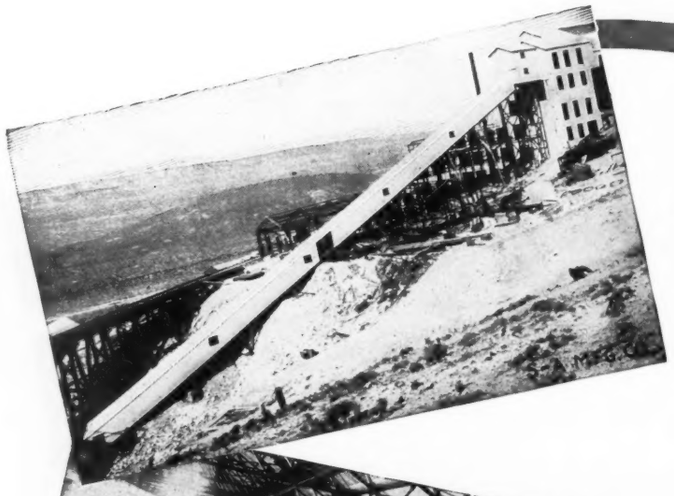
PITTSBURGH, PA.

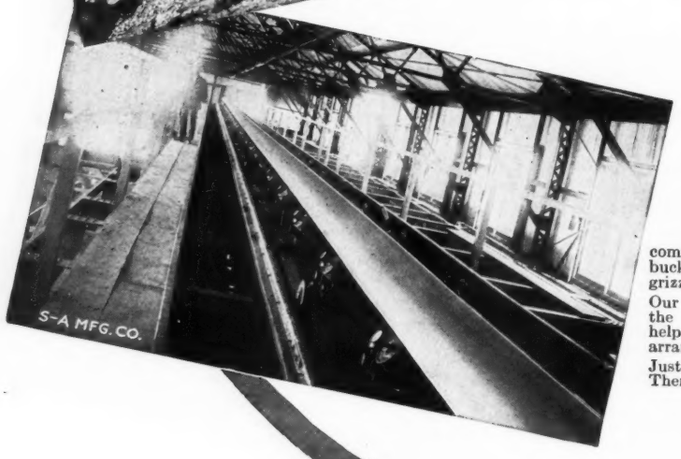
NATIONAL

The S-A Page

Published Weekly in the Interests of S-A Conveying Engineering

One Man Has Charge of These "S-A" Belt Conveyors Handling 900 Tons per Day





At one of the largest gold plants in the country "S-A" Belt Conveyors, aggregating 582 feet in length and 26 inches wide, are handling 900 tons of ore per 8-hour day, between the crushers and the bins.

The labor of just one man is required to keep this immense amount of ore in motion at the plant.

The conveyors are lubricated only once in six months. They operate smoothly with practically no attention, and the minimum in belt wear.

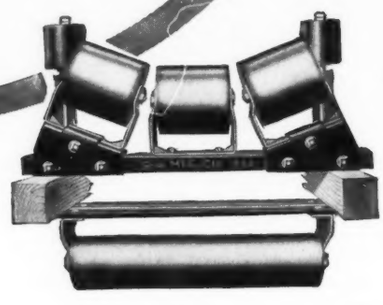
"S-A" CONVEYING MACHINERY

comprises a complete line of belt and bucket conveyors, elevators, trippers, grizzlies, feeders and accessories.

Our engineers will gladly recommend the most economical equipment and help you design its most efficient arrangement in your plant.

Just let us know your requirements. There is no obligation.

We would like to add your name to our mailing list for our monthly publication entitled "THE LABOR SAVER." It's full of live engineering subjects and suggestions that will prove a big help to you. When shall we send it? Write.



The S-A Unit Carrier runs on ball bearings. Requires lubrication only once or twice a year. Saves power and reduces belt wear. Possesses maximum flexibility.

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Engineering and Mining Journal

VOLUME 103 MARCH 31, 1917 NUMBER13

The Lordsburg District, New Mexico

By Faris V. Bush*

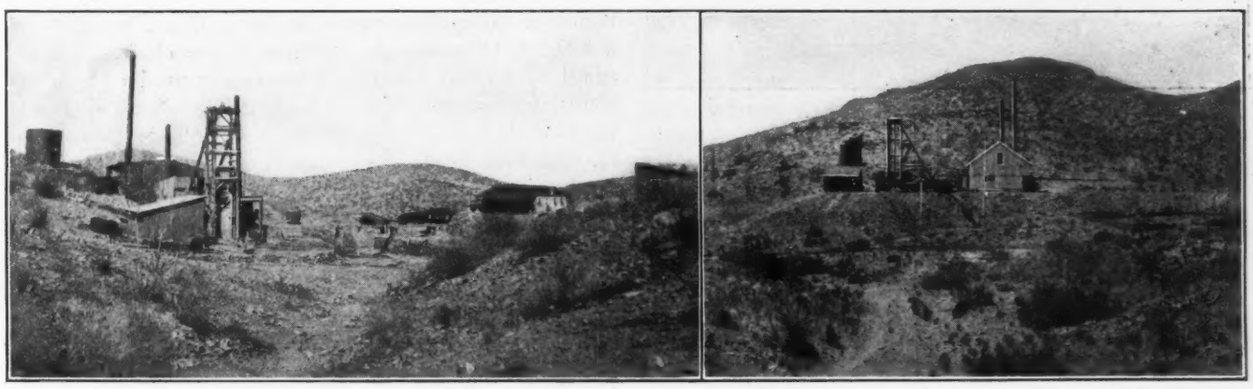
SYNOPSIS—The production of this district has been doubled during 1916. Several mines are in active operation and development is under way at others. The 85 Mining Co., is the largest operator. They are shipping 500 tons daily to the smelters in the Southwest.

From a production of 93,000 tons of ore in 1915 the output of the Lordsburg mining districts for 1916 increased to 186,000 tons. This was the biggest year in the history of the camp. The largest producing companies were the 85 Mining Co., Bonney Mining Co. (through lessees), Crocker and Randall at the Nellie Bly mine, F. Weldon and associates, Trainer and Bonnet and other smaller lessees throughout the camp.

During last year a number of improvements were made at the 85 mine, the largest producer in the camp, which for 1915 reported to the State Tax Commission a gross production of $762,921. The company has added another engine unit to its plants, giving it now two Lyons-Atlas Diesel engines, each with 500-hp. capacity. The mine has been opened to the fifth level, a station cut and development work prosecuted from that point in the blocking out of new orebodies. Although not acquiring any new property, the company has expended a large sum in development work at various points. A new office building and a number of employees' houses have been erected at the 85 camp, and the company has planned a hotel and other buildings near the main office and company store to be built soon. A. J. Inderrieden is manager of the 85 mine and J. W. Jackson is mine superintendent. The company made big strides during last year and it is shipping about 500 tons of ore daily to the smelters in the Southwest.

During 1916 almost all the ore shipped from the Bonney property was mined by lessees. Wells and Sholly, operating the No. 1 and No. 2 shafts, shipped a large tonnage to El Paso and Douglas smelters with excellent returns. Other lessees have made money leasing on various parts of the Bonney property. In the fall of 1916 the property was taken over by the Western Mining and Development Co., composed of Chicago capitalists. Their engineer in charge is J. P. Porteus. The work of this company was confined to the No. 3 shaft. Development work was done, and strong veins of ore were opened up and blocked out for shipping. The company has secured an excellent contract with the Douglas smelters. In January, 1917, the Western Mining and Development Co. was purchased by the San Toy Mining Co., of Mexico.

In the spring of 1916 a rich strike was made by Frank Weldon on the Nellie Gray (formerly Mollie Dream) mining claim and ore was shipped to El Paso smeltery. This mine is now under lease to J. L. Wells, who is continuing shipments to El Paso. The Nellie Bly mine at Leidendorff produced nearly all of the shipping ore of that region for 1916. Col. B. W. Randall and Dr. M. M. Crocker have been shipping an average of 10 carloads of ore monthly from the property. Trainer and Bonnet have operated the Waldo-Beam property adjoining the Atwood and have shipped several carloads of ore also to El Paso. A number of small lessees have done work at various points in the camp and have made good. At the close of 1916 several new companies were coming into the field. The 85 Extension Copper Mining and Development Co. was organized by Miami, Ariz., men to work claims adjoining the 85 mine. The Hecla Min-



THE BONNEY MINE AND THE OCTO MINE IN THE LORDSBURG MINING DISTRICT, NEW MEXICO

*Mining engineer, Lordsburg, N. M.

ing Co. has taken over the property of the Michigan-New Mexico Copper Co. and others in that vicinity. To the south of Lordsburg in the Pyramid Mountains El Centro Mining Co. is operating the Last Chance mine, a silver property, and is achieving considerable success. A number of excellent patented claims including the Viola, Silver Bell and others await further development. The Nellie Bly mine and the Robert E. Lee are practically the only producers in the Pyramid district. These are copper properties.

The prominent outcrops of siliceous dikes near Lordsburg were a great attraction to prospectors in the early days. The indication was always favorable for the occurrence of ore, and the camp of Shakespeare was one of the first in the Southwest to be prospected. In 1885 Matthew Doyle and Vic Van Hall located five mining claims on a prominent mountain three miles southwest of Lordsburg. They named one of their claims the 85 on account of the year of the location and proceeded to do development work on the main vein, opening up a good grade of copper, gold and silver ore. About one year later some San Francisco mining men heard of the strike at the 85, and they made Doyle and Van Hall a

ORE BINS AT THE 85 MINE

proposition which was accepted. These men did further development work at the mine and incidentally incurred a heavy indebtedness at the Roberts and Leahy Mercantile Co. at Lordsburg. The San Francisco interests were not successful with the mine, and it was soon acquired by Joseph A. Leahy, who, together with Carl F. Dunnegan and Albert Fitch, worked the mine for about a year, shipping an average of 100 tons of ore daily from the main vein. Leahy, Dunnegan and Fitch were very successful in their operations of the 85 mine and took out ore that brought the mine into prominence.

In 1906 a mining engineer by the name of W. P. Black was en route to Clifton, Ariz., to look over some mining property there. In passing through Lordsburg he saw some of the ore from the 85 mine and immediately became interested. He inspected the property and made the owners a proposition which was accepted, and by 1907 the mine was sold by Mr. Black to James Barclay, B. P. Yates and Arthur and Charles Warner, all of Beloit, Wis., for $75,000.

James Barclay, one of the owners, came to Lordsburg and began the first extensive development work at the property. To his efforts much of the present success of the company is due. He secured the services of a practical miner, John Evans, and together they put Lordsburg and the 85 mine on the map.

There are five levels in the mine, the lowest being 515 ft. from the collar of the main shaft and 720 ft. from the surface of the mountain. A main adit has been driven from the east side of the 85 mountain 1500 ft. west, where a winze is down 515 ft. This main adit connects with the workings of the Superior mine, as do also the first and second levels of the main property. Mining is carried on at all five levels, but principally on the 450-ft. level where the lateral work extends west 1700 ft. The ore is mined by the shrinkage-stope method with chutes every 20 ft. The shaft is single-compartment with a counterbalance. On the 450-ft. level a 50-hp. motor drives a three-plunger Alrich pump lifting 250 gal. of water per minute. There is also a 175-gal. per min. pump on this level. On the 300-ft. level a pump is lifting 75 gal. per minute.

The Bonney Mine

In January, 1917, a transaction was made whereby the Bonney mine, owned by the Western Mining and Development Co. was sold. Donald B. Gillies is consulting engineer and Oliver Powers, general manager. The Bonney mine in one of the richest in the district, with an average value of $20 per ton in gold, silver and copper. Ore as high as $80 and $100 per ton has been found in many places in the Bonney veins. The ore is not so high in silica as the mines to the north, but will average 69%. There are three deep shafts on the property. The No. 1 is 120 ft. deep on a 6° incline. This was the first shaft to be sunk on the property. The No. 2 shaft is 261 ft. deep with four levels and over 1000 ft. of lateral work developing large bodies of ore. The main vein at the bottom of the No. 2 shaft is 19 ft. wide composed of a shipping grade of ore. There is an 18-hp. boiler, a 40-hp. horizontal boiler, a 5-hp. engine and a 120-hp. Ottumwa steam hoist at the shaft. On account of lack of adequate dumping ground and on account of excellent surface indications, the No. 3 shaft was begun early in 1915, west of the No. 2. This is down 420 ft. with four levels and a 25,000-gal. sump on the third level. The equipment at the No. 3 consists of two 100-hp. boilers, two 100-hp. heaters; one 20-hp. steam hoist; a Sullivan two-stage compressor with three drills; reversible blower and a complete machine shop. During the development work on the No. 3 shaft several high-grade veins were encountered, and at the 420-ft. there is a 5-ft. vein. There are 17 veins on the Bonney property, practically all of them outcropping at the surface in widths up to 30 ft. The strike of the veins is 45° to the northeast and southwest, and the dip is 76° to the northwest. Practically all the veins are parallel. The copper ore occurs as cuprite, chalcopyrite, azurite and malachite. The veins are all well defined.

Export Duty on Malay Tin Ore

A notice of a revision of the export duties on tin ores from the states of Perak, Selangor, Negri Sembilan and Pahang is published in the *Federated Malay States Government Gazette,* of Dec. 30, 1916.

Under the new ruling, tin ore, exported under such guarantees as the Resident may require that it shall be smelted in the Straits Settlements, Australia or the United Kingdom, is dutiable at 72% of the duty on tin, while without such guarantees the tax is 72% of the duty on tin plus $30 per pikul.

Unwatering an Inclined Shaft

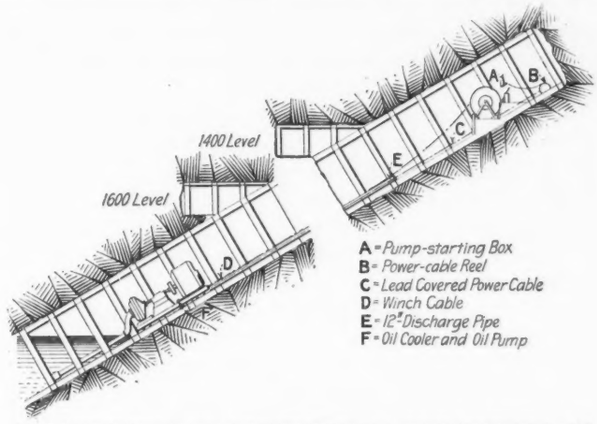
By James E. Harding*

SYNOPSIS—Difficult operating conditions on the Comstock, brought about by great heat, badly swelling ground and highly acidulated water are described and the methods of unwatering a shaft that had been under water 35 years are given. An electric-driven centrifugal pump was used.

Mining on the Comstock Lode, Nevada, is a long series of encounters between man and natural obstacles, the most striking of which are a normal underground temperature of 106° to 120° F., badly swelling ground and highly acidulated mine water that runs anywhere from lukewarm to the boiling point.

The methods used in handling a pumping problem at the mines in Gold Hill, on the south end of the Comstock, are of interest. The pumps were operated in an incline dipping 29°, which had been under water about 35 years and in which the timber and track were of course in a bad condition. The difficult conditions should be kept in mind as reason for the somewhat peculiar methods which it was found necesary to use.

The pumps, owing to the heat in which they were to operate and the hot water which they were to handle, had to be of special design throughout. They were of the single-stage centrifugal type with impellers of bronze, capable of elevating 1800 gal. per min. to a height of 750



ARRANGEMENT OF EQUIPMENT IN UNWATERING AN INCLINED SHAFT

ft. while running at 880 r.p.m. Direct-connected on each pump shaft was 200-hp. motor operating on 440 volts at 60 amperes. Owing to the fact that the pump was to operate on an uneven and shaking foundation, both the impeller case and motor were bolted solidly to a heavy and rigid cast-iron base and then trussed together to prevent the pump and motor shafts from getting out of alignment. The total weight of this unit was slightly over 10 tons.

The motors had ball bearings running in oil and had a special cooling system. A small centrifugal pump and a jacketed worm were bolted on the pump bed between the motor and impeller, and a ¾-in. pipe line connected both motor bearings and led back through the worm to the small circulating pump. This will be seen marked *F* in the accompanying sketch. A line of 1-in. pipe brought cold water down the incline and into the worm jacket, and the outlet of the worm jacket was piped so that it flowed over the impeller and thrust bearing. Thus one stream of cold water cooled all bearings.

In preparing for the installation of the pumps, a station was cut a few feet above the 1400-ft. level, in which were installed a 50-ton electric winch, the starting box, marked *A* and the reel of lead-covered power cable, marked *B* in the sketch. The power cable reel was placed in such fashion that the cable could be sent down with the pumps by merely revolving the reel and allowing the cable to run down in a wooden box, which protected the lead covering as well as lessened friction.

To make working conditions possible for the men, a 10-hp. fan was put in on the 1400 station, where there was cool fresh air, and an 18-in. ventilating line carried down the incline directly to where the men were working. This line was always advanced with the pumps. Two tubs of ice water were always kept near-by; one contained water for drinking purposes and the other a "dabbler" into which the men plunged arms, head and shoulders to cool off. The men worked stripped to the waist and dripped with sweat continually. The temperature generally was below 110° except when the power went off, shutting down the ventilation, and then the temperature rose very rapidly to a point where a man could bear it but a few minutes. In such cases everyone started immediately for a cooler place. As the power line came through a mountainous country, such shutdowns were of frequent occurrence, especially in the winter time.

With the installation of this equipment everything was in readiness, and all connections were made and actual pumping started. At first some mechanical difficulty was encountered while the machinery was getting limbered up, and in training the men to operate the pumps, but these difficulties were overcome one by one and everything was running smoothly within two months.

The incline timbering was found to be in fairly good condition until a point just above the 1600 level was reached, where a cave-in was encountered. It was necessary to put a skip into one compartment to take away the débris, and after this the water was handled with only one pump. The difficulties began at this stage. An old Cornish pump had been installed in the original work in the incline. It had to be cleared out of the way, together with its rods and water column. The old pump and water column were of cast iron, and these had to be broken up with hammers and dynamite. The rod was of wood 12x12 in., with two sides reinforced by 1x10-in. strap iron bolted through. This strap was of a fine grade of wrought iron, and although it had been under acid water for years, it was practically unaffected. It could not be broken and so was cut up with cold chisels. This work was very slow, difficult and expensive, owing to the heat in which the men had to work. Probably it could have been done more cheaply with an oxyacetylene cutter if one had been available. When the débris was cleared away ahead of the pump sufficiently to permit it to be lowered, the real speed of the work was made.

*Care of American Smelting and Refining Co., Caldera, Atacama, Chile.

Owing to the rottenness of the old timber, the pump could not be merely blocked against it. At the upper end of the pump bed an anchor cable was attached and the upper end of this cable wrapped around three sills in the floor of the incline. This cable was tightened up with a turnbuckle to hold in case the blocking below gave way. When everything was in readiness to lower, the winch cable was tightened up as much as possible, the anchor cable loosened and the blocks below taken out, the pump being allowed to run, held by the winch cable alone until the suction was out of water. The valve in the water column above the pump was closed, and the signal was given to the man at the winch station to cut off the power in the lead cable and lower away. Breaking the water column gave no trouble as it was of wood-stave pipe, 12-in. diameter with tapered ends jammed into wrought-iron bands. When the pump was lowered sufficiently to allow the insertion of a 15-ft. section, the signal to stop was given and one end of a new length of water column inserted in the joint at the pump. Then the signal to hoist was given, and as the pump came slowly back, the other end of the water-column section was guided into the band above and the whole cinched as tightly as the winch could do it. Two men then blocked below, and two others tightened up the anchor cable above, and the pump was ready to start pumping again.

The control valve had been placed in the outlet of the pump instead of the suction, to allow more leeway when the water rose, and so the pump had to be primed. The primer furnished with the pump proved unsatisfactory, so a hand pump was used. This was at first connected to the impeller case by a hose, but later the hose was discarded. Finally the priming device was the hand pump bolted to the pump bed and piped with sealed joints to the impeller case. This proved satisfactory, enabling the big pump to be primed in less than a minute. When water came through the hand pump, it was known that the big pump was primed and ready to start.

Pump Operations Indicated by Ammeter

In starting there was no indicator except the ammeter at the winch station to show what the pump was doing. When the signal was given to the man at the winch station to throw on the power, the ammeter generally showed about 250 amp., and as the pump gathered speed the needle came slowly back to 140-150 amp. when full speed was turned on at the starting box. The pumpman below watched the electric lights grow dim and then bright and judged the speed of the pump. Of course the brightness of the lights and the speed of the pump increased synchronously, and when both came to about normal, the outlet valve of the pump was opened. After few trials there was no trouble in resuming.

Working in this way, a quick change was possible. The record time from shutdown to start-up was 57 min. and generally averaged a few minutes more than an hour. The entire operation as far as the pumping went was a success. I think it will be conceded that the pumps worked under most unfavorable conditions. However, not the slightest trouble was ever experienced with them after the first month, during which the bearings heated up, but this difficulty passed away after they had become "worn in." The water was lowered to the 1690-ft. mark and held there with one pump for over seven months with only occasional shutdowns necessary for repacking.

Cataloging Minerals and Mining Engineers for War Purposes

Washington Correspondence

Each mineral affected by war conditions is to be the subject of a concise review by the United States Geological Survey. The object is to show the present status of mineral production and of the mineral industries from the standpoint of the development witnessed and the experience gained since the outbreak of the war. Special attention is being given to conditions and to the demand that will confront the United States in case of war.

The work has been assigned to the regular geologists having charge of each of the minerals to be reviewed. They will show what has been accomplished under the extraordinary stimulus of foreign war markets on the one hand, and of restricted or even totally obstructed importations on the other. An effort will be made to show the ability and the extent to which the mineral industries can meet possible superimposed demands of war. Limits as to the mineral available for mining, smelting, coking and refining will be discussed. The rate of expansion under pressure as estimated on the basis of what has been achieved since September, 1914, will be calculated. The adequacy of the mineral reserves of the country and the possible development of new reserves of special type to meet greater demands or to replace importations will be considered.

The result of this work will be published as a bulletin, which will be the logical successor of the brief summary, Bulletin 599, published a few weeks after the beginning of the war. That publication outlined what might be expected of the United States in developing industrial independence. The new bulletin will state what has been accomplished.

Mining engineers and metallurgists are being requested by the Bureau of Mines, "as a patriotic duty," to fill out a card on which some 40 questions appear. "European experience," says a letter which will accompany the questions, "has shown that nothing is more important in time of war or national emergency than a knowledge of the qualifications and experience of expert technical men. It is therefore important, especially at present, that this information be available in the United States." The information is being collected by the Bureau of Mines, in coöperation with the American Institute of Mining Engineers. The work of gathering these data was undertaken at the request of the Council of National Defense. Similar information is being sought from chemists. The American Chemical Society is coöperating with the Bureau of Mines in the effort to secure the information from the chemists of the United States. Among the more significant questions asked are: "In case of an emergency, how and where, in your opinion, could you be of most service to this country?" "In what countries have you had experience, and how much?" "What foreign language do you speak?" "Are you an American citizen?" "Where were your parents born?" "Give character of machine and repair-shop experience." These questions are in addition to those as to name, address, age, education, technical-society affiliations, positions held and published writings. Numerous subdivisions are made under the heads of "Mining" and of "Ore Reduction" to establish the exact class of mining and metallurgical experience of each of the men addressed.

Native Copper in Arctic Canada*

Copper has been reported from three separate localities in the region about Coronation Gulf; only two of these have been visited by white men. The first locality is that in the Copper Mountains, which run in a broad curve, concave to the north, and are intersected by the Coppermine River about 35 miles south of Coronation Gulf. This locality has been briefly reported on by Dr. August Sandberg.[1] The second occurrence is in and about Bathurst Inlet and was investigated by the Canadian Arctic Expedition in 1915-16.[2] That copper occurs about 40 miles north to northeast of Prince Albert Sound, Victoria Land, is the statement of many Eskimos who live in that region and frequently go there for their copper in the summer.

Tœe Coppermine River Deposit

The Copper Mountains are composed of a series of superimposed flows of basaltic lava, with occasional interbedded conglomerates, which occupy a belt 16 miles wide where cut by the Coppermine River and which have a general dip of about 12° to the north. These rocks are reported to occur for at least 40 miles west of the Coppermine River, and to the eastward are bounded by older rocks, which reach the coast at Port Epworth about 75 miles east of the mouth of the Coppermine River.

Native copper was actually seen by Dr. Sandberg in two places near the Coppermine River: (1) At Copper Creek in an exposure of basalt 30 ft. in thickness. The copper was in amygdules and as tiny shots or flakes in the massive portion of the rock. (2) At Burnt Creek, copper occurred similarly through a total thickness of 51 ft. of basalt and in pebbles in 25 ft. of conglomerate.

Copper stain was seen in many other flows. Pieces of float copper are found on the morainic material north of the Copper Mountains; one piece brought back by the Canadian Arctic Expedition weighs more than 35 lb. and Eskimos report an abundance in places, some of which they cannot handle.

Not much information is available concerning the occurrence of copper on Victoria Land, and it is not established whether the copper is in place or in float. The Eskimos, who visit the region northeast of Prince Albert Sound, report that large masses of copper, much larger than a man's body, protrude from the hillside in places and are cut off by them for weapon-making, etc., as required. The Northern party of the Canadian Arctic Expedition obtained a piece of copper weighing about 40 lb. from some Eskimos who obtained it at this place.

The copper-bearing rocks in Bathurst Inlet are apparently distinct from those about the Coppermine River; they occupy a pear-shaped area extending about 50 miles northwest-southeast by about 25 miles at the greatest breadth. This area includes more than 200 islands ranging in size from a few hundred square yards to several square miles, also part of the western mainland—Banks Peninsula, and a strip of coast from Arctic Sound to Moore Bay and 5 or 6 miles inland. The islands and Banks Peninsula have been mapped and investigated, but the copper content of the remainder of the mainland has not been established, although the same rocks are known to occur there. The formation is a series of basic lava flows with three thin beds of sediment. The total thickness is over 400 ft. on Banks Peninsula, and native copper was actually seen in rocks representing over 350 ft. of this thickness. Similar rocks are found throughout the area where exposed on the islands. The general dip is about 6° and makes a shallow basin of the area.

The copper occurs in three forms: (1) As vein-copper, in thin fissures in the rocks. (2) As amygdaloidal copper; irregular grains and small masses in the branching gas cavities near the surface of the flows. (3) As disseminated copper; minute flakes scattered throughout the ground mass. Nos. 1 and 2 are locally important, but No. 3 is the most widespread.

Vein copper occurs as thin sheets of native copper and as small flakes and pieces scattered through a matrix of quartz, calcite, etc. A sample of the latter from a half-inch vein assayed 4.56% copper. In parts of the area this vein-copper is quite important in amount, but no attempt was made to estimate its relative importance.

Amygdaloidal copper is found in the upper portion of the flows, where the gas cavities were numerous and a free passage was permitted to the mineralizing solutions. Only occasionally was this type visible for examination, because of accumulations of talus or of snow along the cliff face. A sample from one of the exposures gave 1.44% copper and 0.05 oz. (Troy) of silver per ton of 2000 lb. No estimate was made of the amount of this material available.

Disseminated copper occurs over the whole area of more than 1000 square miles and practically through the whole thickness of the formation. Analyses of 45 representative samples show that the values range between 0.01 and 0.25%. This copper is in tiny flakes and can usually be seen with a lens.

Occurrence of Bornite and Galena

In many parts of the southern half of the area of copper-bearing rocks in Bathurst Inlet a series of dolomites immediately underlies the basalts; the upper few feet of this series is partly replaced by bornite in layers and masses. Exposures occur in cliffs facing the east and southeast, notably on the islands Kanuyak, Barry or Ekullialuk, Iglor-u-ullig and Algaq, and along the east base of Banks Peninsula.

Thin veins of galena occur at Galena Point, Bathurst Inlet, cutting the granite. The veins are seldom more than 3 in. in width, or more than 20 ft. in length, pinching out at both ends. Only four or five veins were seen in making a traverse of about 1½ miles across the point. An analysis of this galena shows only a trace of silver.

Water power is available from the Hood, Tree and Coppermine Rivers. Oil occurs in the basin of the Mackenzie River as far north as Fort Norman at least. Lignite coal has been reported from the north side of Bear Lake, on the Horton River, and on the north coast of Banks Island.

It has been said that there are only two seasons in the north—winter and late in the fall. This is far from the truth, for even the Eskimos divide the year into five distrinct periods, or seasons, and conduct their movements accordingly. A decided break from the grip of winter occurs about the middle of April, and by the end of May all the snow has disappeared from the land except

*From an address by J. J. O'Neill, before the Montreal Branch of the Canadian Mining Institute, Jan. 12, 1917; "Bulletin" of the Institute, March, 1917.

[1]Appendix B, "Lands Forlorn," by George M. Douglas.

[2]Report not yet published.

where large drifts occur under the cliffs. The sun is quite hot in April, the seals come out on the ice and the caribou begin their migration to the northern islands; in May the wild fowl arrive and then the small birds; the sun shines for 24 hours and the vegetation responds rapidly, so that by the middle of June many wild flowers are in bloom, the slopes and valleys are green and the small mammals are disporting themselves everywhere. At this time the flies are beginning to make their presence felt, and soon the mosquitoes are so numerous that one is reminded of the summer in northern Ontario; black flies are rare on the coast, but are too abundant along some of the rivers. The rivers are usually free of ice by June, and by July most of the small lakes are open. Great Bear Lake breaks up about June 20, and the ice in Coronation Gulf about the same time; the ice is then rapidly crushed into small pieces and disappears before August. The ice which offers obstruction to navigation is that in Beaufort Sea, which drifts around all summer and responds to any variation of wind or tide. By September the days are shortening and light snowstorms occur; by October all the small lakes are frozen and the swift rivers freeze before the middle of the month; all the birds have departed for the south, and by the end of the month the shore-ice is thick enough to permit of traveling by sled. The sun disappears altogether in November, but even in the middle of December there is sufficient light for traveling for about five hours on clear days. The mean temperature for the five months, November to March inclusive, in the winters of 1914-15 and 1915-16, at Dolphon and Union Straits was —15° F. The minimum was —49° the first year, and —44° the second. The total snowfall does not exceed three feet, and the wind keeps the islands and coast rather barren. Thaw takes place to about 21 in. depth during the summer, but below that depth the ground is permanently frozen. In the summer the maximum temperature recorded on the coast was above 60° F., and the mean for the months of June, July, August and September, was above 32° F. Hence climatic conditions are by no means prohibitive to settlement in this region. Game and fish abound. In short, there should be little difficulty in establishing a mining industry should the deposits warrant it.

The Canadian Cobalt Industry*

Cobalt is a Canadian product of some importance to the country, as almost the entire supply of the world is drawn from the mines of Ontario. This metal was formerly largely a German product, and for two or three hundred years that country controlled the supply, but prior to the discovery of the Canadian product the ores of New Caledonia had become the main source of supply. These mines, however, were forced to close when brought into competition with the cheaper supply from Ontario. The ore and concentrates produced in the Temiskaming district of Ontario contain from 4 to 10% cobalt, 2 to 8% nickel, 15 to 40% arsenic, and from 500 to 5000 oz. of silver per ton.

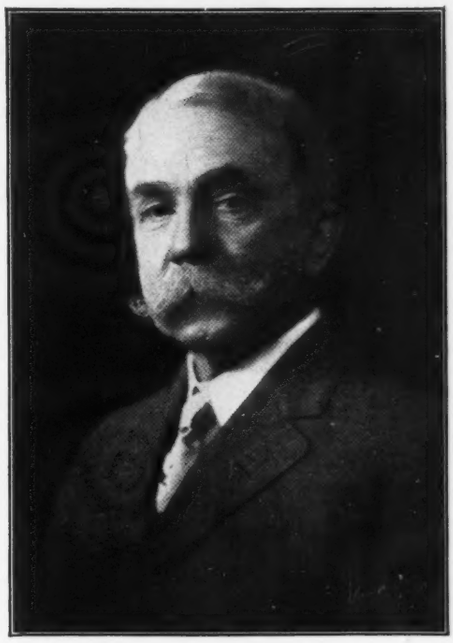
During the early days of mining in the Cobalt district much ore was exported to the United States and treated for its silver contents, the cobalt being slagged and lost. Now, only a small amount of the rich cobalt ores is exported to that country, but a considerable tonnage of low-grade concentrates, low in silver, nickel and cobalt, still goes to the American smelters and is treated for its silver contents only. Two or three of the mining companies at Cobalt have erected plants for desilverizing their high-grade ores and concentrates, leaving the cobalt, nickel and arsenic in residues for shipment to cobalt smelters. Germany received some of this product before the war. A small quantity is now sold in England, while the larger portion is handled by southern Ontario smelters. During the past years the smelting industry of Ontario has been steadily developing and handling a larger percentage of the ores and concentrates from the Temiskaming district. The principal southern Ontario smelters treating the silver-cobalt ores are the Deloro Smelting and Refining Co., and the Coniagas Reduction Co. In addition to this the Metals Chemical Co. is treating some of the desilverized residues mentioned. These smelters save and market as refined products all the valuable metals in the ores; namely, silver, arsenic, nickel and cobalt. The last-named metal is largely marketed as cobalt oxide, but also in the metallic form and to a limited extent in salts. The output of the works mentioned is largely controlled by the market demand for cobalt, as they could readily increase their production if circumstances warranted it. A few years ago practically the only market for cobalt was in the ceramic trade, where it was employed for whitening the body of china and in the production of blue color in that industry. It is employed in the enameling trade, the manufacture of blue-colored signs, the coloring of glass, and in a small way in the manufacture of paints such as cobalt blue. These industries could consume only three or four hundred tons of cobalt per year. In the last few years, however, new uses have been found for this metal. There has been an increase in the consumption of cobalt salts for such purposes as the manufacture of cobalt driers for paints.

The use of cobalt in the metallic form is increasing. It has been found that it has several advantages over nickel for electroplating, a smaller quantity having a greater resistance to abrasion, and with use of a proper bath it can be plated much more rapidly. In the manufacture of high-speed steels, cobalt has been used as an alloy to considerable advantage, as for instance, in the manufacture of the so-called Becker steel, which became of some little commercial importance in Germany just before the war. Other brands of cobalt steel are also on the market. A new cutting metal called "stellite," composed of cobalt, chromium and tungsten without any iron, has proved to be superior to high-speed steel for many operations. It is claimed that this metal is to high-speed steel what high-speed steel is to ordinary carbon steel; that is, it will allow of increasing the rate of cutting on the lathe from 20% to 50% and minimizes the time consumed in sharpening tools. The development of the cobalt industry in Ontario has been greatly assisted through the action of the Ontario government in granting, some years ago, a bounty of 6c. per lb. for all cobalt and nickel refined in that province. The Dominion government, also through the Department of Mines, assisted in the attempts to develop new uses for this metal by a vote for research work conducted in the metallurgical laboratories of Queen's University. It was here that cobalt plating was developed.

*From report of Special Committee on Metal Industries to Canadian Mining Institute, "Bulletin" of the Institute, March, 1917.

Officers of The Mining Societies

W. R. INGALLS
President of the Mining and Metallurgical Society of America



PHILIP N. MOORE
President of the American Institute of Mining Engineers

WALDEMAR LINDGREN
Vice-president of the Mining and Metallurgical Society of America

SIDNEY J. JENNINGS
First vice-president of the American Institute of Mining Engineers

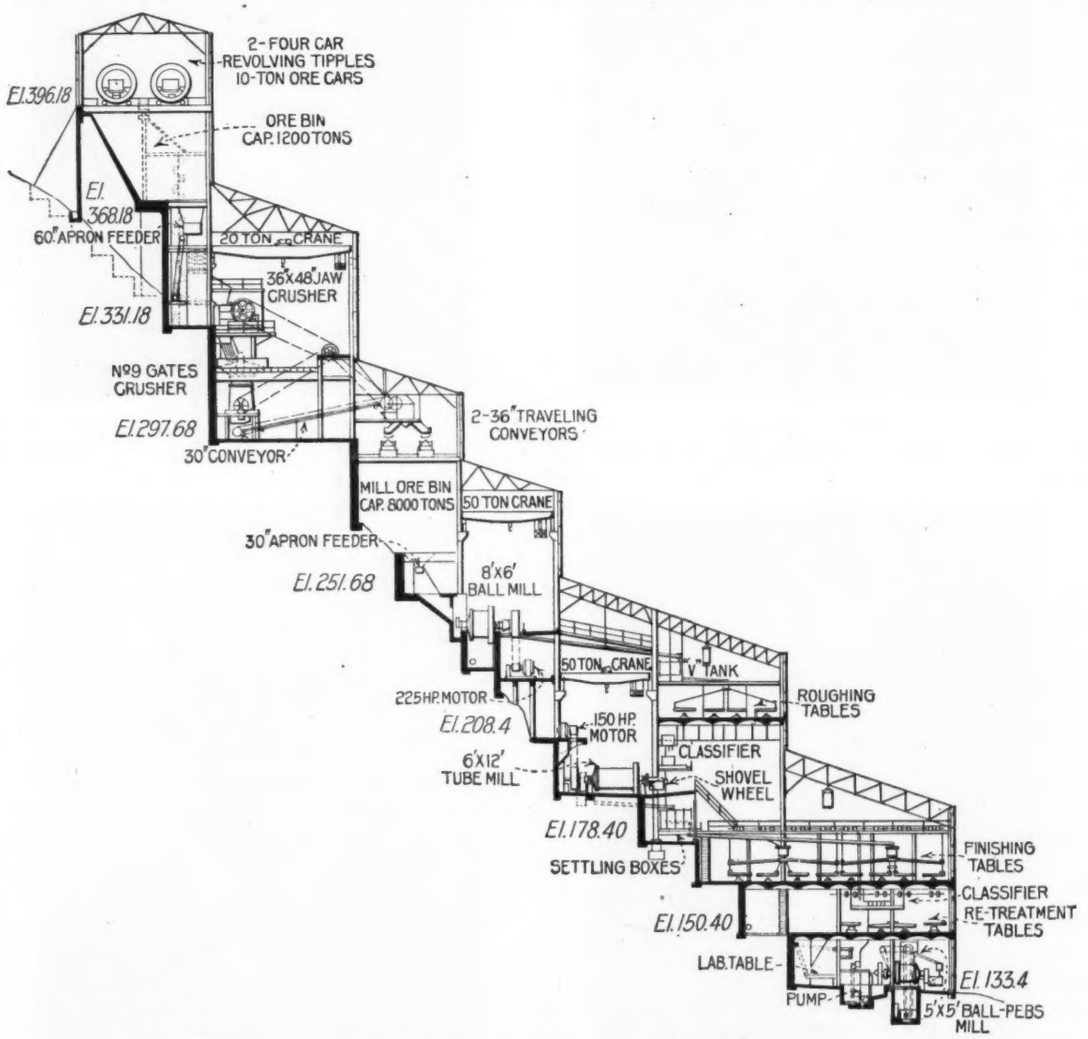
The Alaska Juneau Mill

SYNOPSIS—New gold mill fast nearing completion to have capacity of 10,000 to 12,000 tons. Crushing and concentrating are the only milling methods used, crushing being done by ball mills and tube mills.

The new mill of the Alaska Juneau Gold Mining Co. is situated near Juneau, on Gastineau Channel, opposite Douglas Island, Alaska. The mill is constructed for a minimum capacity of 8000 tons per day, but probably will be able to handle 10,000 tons, or possibly even 12,000 tons per day under favorable conditions. The expected output is based upon the performance of the ball mills, and the output will depend a great deal upon how they handle the ore. The mill is so designed as to reduce operation costs to a minimum, and contains no appliances that can be dispensed with. The process in use is entirely crushing and concentrating, the class and kind of equipment being clearly shown in the accompanying drawings and flow sheet.

Both ball mills and tube mills are provided for secondary crushing, classifiers handling the material between the two. The mill building itself is a steel structure and is especially designed to suit the climatic conditions in this part of Alaska. Foundations, both of the mill building itself and the machinery, are of concrete, practically all of which have been completed at this time.

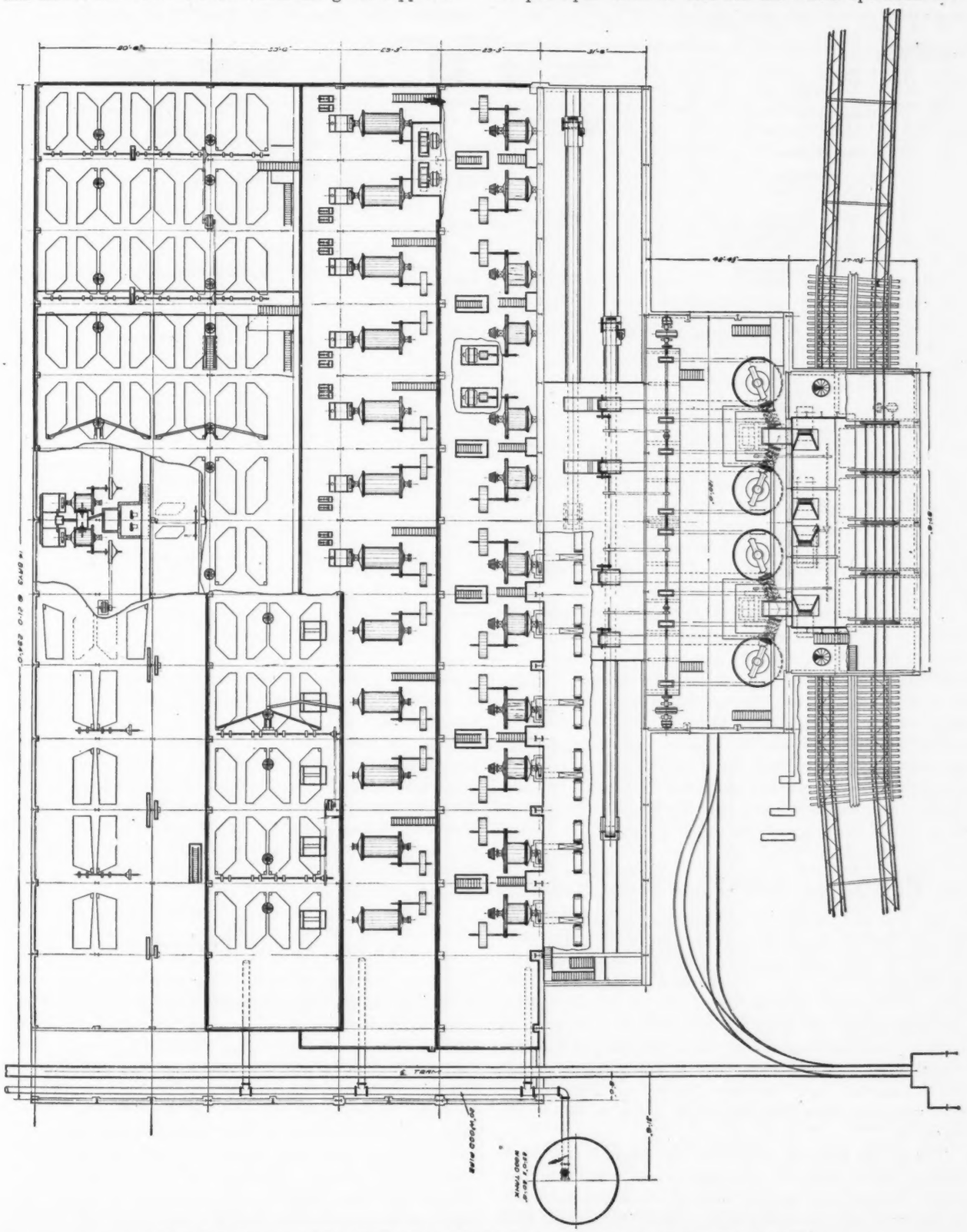
Ore from the mine is carried to the mill in steel cars, which are received in tipples at the top of the mill. These tipples are of the revolving type, and dump by inverting the cars. The ore is received in a 2000-ton bin, whence apron feeders carry it to grizzlies having 8-in. opening. The oversize passes through jaw crushers where it is reduced to 6-in. size, and then, joining the undersize from the grizzly, passes over a second grizzly with 3-in. opening. From this grizzly the oversize passes through a gyratory crusher that reduces to 3-in. size. The ore is then distributed to the mill-ore bin by a system of conveyors and distributors that allows the material to be deposited at the point where it is most needed. It will be seen then that the ball-mill feed is 3-in. material and, as shown in the flow sheet, the screens at the ball-mill delivery provide a 10-mesh undersize and an oversize that is reground in tube mills. The hillside site of the mill being steep provides satisfactory fall for gravity flow throughout.



CROSS-SECTION THROUGH NEW ALASKA JUNEAU MILL

Mechanical distributors are provided for distributing the pulp to both roughing and finishing concentrators. Deister, 3-spigot classifiers are provided to follow the roughing concentrators, the oversize being ground over again in a 6 x 12-ft. tube mill. Separate collection receptacles are provided for lead and gold concentrators, and all modern conveniences for handling are supplied.

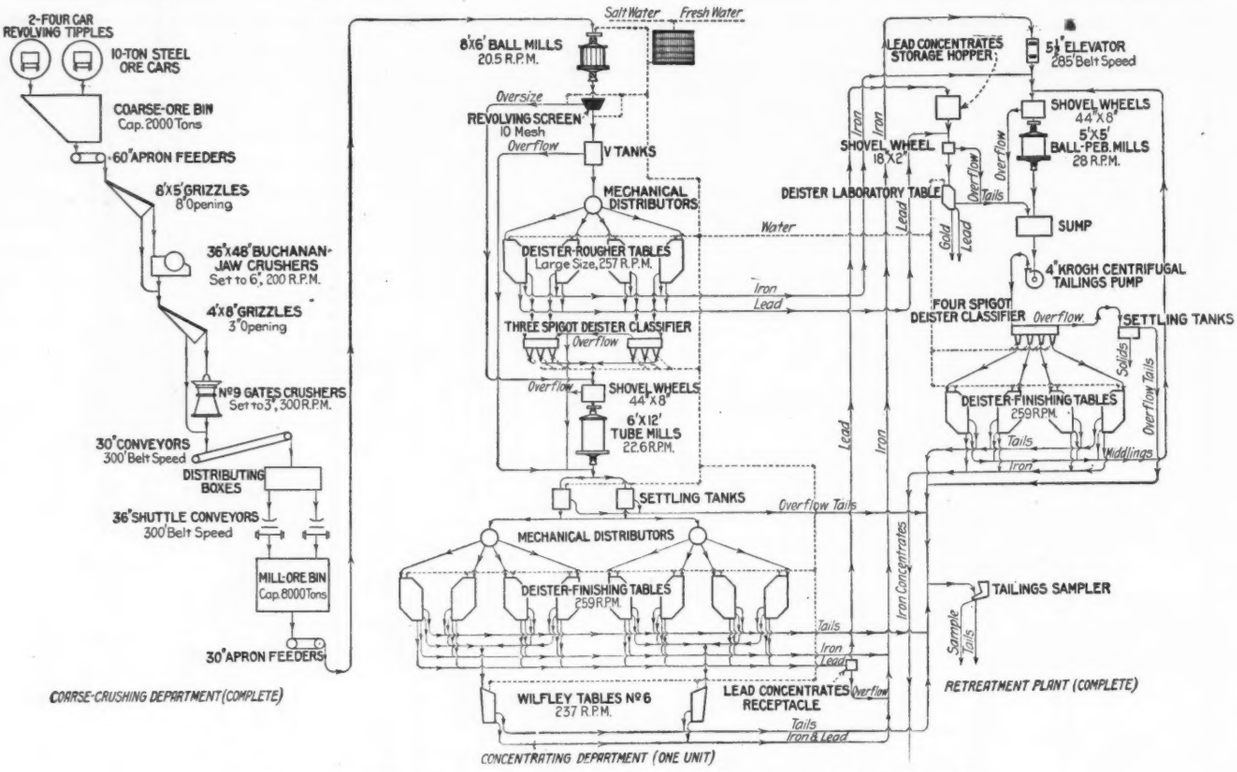
Power is generated in a separate power house, equipped with boilers, economizers and turbines. As has been noted, the metallurgical process is concentration, which is accomplished first on roughing tables and then on finishing tables. Such highly efficient methods have been instituted at the mine and provided for at the mill that the principal items of cost for the whole operation are



PLAN OF THE ALASKA JUNEAU'S NEW MILL ON GASTINEAU CHANNEL, ALASKA

expected to be tramming and milling. The caving system laid out for working the mine has already been so successfully put into operation that the mine is quite ready to supply the mill at its maximum capacity.

The Alaska Juneau mill is one of the latest designs of modern concentrating-mill construction and embodies the most highly developed ideas of mill planning. The mill is so near completion that operation is expected to be



FLOW SHEET OF THE ALASKA JUNEAU 10,000- TO 12,000-TON MILL

commenced some time in April. In the *Journal* of Mar. 17, were many progress photos of this mill, showing various sections under construction.

This mill was designed by Bradley, Bruff & Labarthe, San Francisco, and is being built under their supervision. It is by their courtesy and that of F. W. Bradley, president of the Alaska Juneau that we are able to publish these official drawings of the mill.

Protecting California Oil Fields

The first annual report, covering the work of the State Mining Bureau in protecting California oil fields from infiltrating water, has just been published and is ready for distribution. The report summarizes the physical conditions encountered and the means of carrying on the supervision under the state law which became effective in August, 1915, and authorized State Mineralogist Fletcher Hamilton to appoint an engineer to direct the work. R. P. McLaughlin has filled the position of state oil and gas supervisor since that time, and is the author of the report.

The report consists of almost 300 printed pages and contains much technical information not previously published, together with general descriptions of various phases of the work and the policy under which the law has been administered. There is a financial statement covering the $20,000 spent during the last fiscal year and comment on the economy of such expenditure for work insuring the total of $250,000,000, which is already invested in California oil operations. Recent developments in various fields are covered in detail, and maps show the exact location of the 80,702 acres of proven oil lands in the state.

A feature that should be of general usefulness is a complete directory of all incorporated oil companies, giving names of officers, capitalization, number and location of wells, besides showing whether or not the company produces oil.

Upon the facts presented in the report of its work and experience, the State Mining Bureau has framed the amendments to the present law and anticipates no difficulty in proving the necessity for the changes. The report will be distributed to the oil operators by the State Mining Bureau from its offices at the Ferry Building, San Francisco, and 520 Union League Building, Los Angeles.

Nickel in the United States

During the general stocktaking which has been going on in the United States during the last year many questions as to the country's resources in nickel have been asked. The American nickel deposits are small compared with the unrivalled deposits at Sudbury, Canada, but they have in the past made some production, and will probably do so again. Nickel in quantities sufficiently large to incite attempts to exploit the deposits on a commercial scale has been found in California, Colorado, Connecticut, Idaho, Missouri, Nevada, New Mexico, North Carolina, Oregon, Pennsylvania, Virginia, and Washington under very diverse conditions, and smaller deposits have been found in other States.

Lake Superior Mining Institute Annual Meeting

MICHIGAN CORRESPONDENCE

The twenty-first annual meeting of the Lake Superior Mining Institute was held in the Birmingham district, Alabama, Mar. 13, 14 and 15, with about 150 members and guests in attendance. It was the longest trip ever taken by the organization and was highly instructive and entertaining from start to finish. A few hurried North before the trip was completed, as it was feared that the threatened railroad strike would cause them some inconvenience if passenger service was discontinued.

The party assembled in Chicago on Saturday, Mar. 10, and the special train departed from there that night for Chattanooga, Tenn., which was reached on Monday morning. The day was spent in sight-seeing in and about the city, the visitors greatly enjoying the visits to Lookout Mountain and the battlefields of Chickamauga and Missionary Ridge.

Birmingham was reached on Tuesday morning, and the local committee there had a strenuous two-days' program outlined, which was followed closely. Tuesday morning was spent in looking over the surface equipment of the Ishkooda, Wenonah and Muscado iron-ore mines of the Tennessee Coal, Iron and Railroad Co. A barbecue was served at noon at Bayview, where the Tennessee company is opening up a new coal property which is destined to be one of the largest in the district. In the afternoon the Edgewater coal mine of the Tennessee company and the plant of the American Steel and Wire Co. were visited. The Northerners were greatly interested in witnessing the manufacture of wire rods, barb wire, nails, etc., as it was all new to many of them. In the evening a business session was held, when committees were appointed and several papers were read.

On Wednesday morning the party was taken to the Thomas furnaces of the Republic Iron and Steel Co., after which a stop was made at Docena, where the Tennessee company has a new coal property and a coal-washing plant that cost about $300,000. There is also a model town there, just completed. The remainder of the morning was spent at the Ensley mills of the Tennessee company, where the crude materials, all of which come from the Birmingham district, are made into pig iron and then into steel. The greater part of the steel is rolled into rails, although some is shipped east in the form of billets.

In the afternoon a second business session was held in the Tutwiler Hotel, when officers were elected for the ensuing year and resolutions adopted. In the evening the Birmingham Athletic Club entertained the party at a "stag" in its gymnasium.

There was no set program for Thursday, the visitors being given the privilege of going underground in coal or iron mines or visiting the cotton mills. Some, however, took advantage of the fine golf courses to get a little exercise. The return trip North was started that night, a stop being made on Friday morning at Knoxville, where the mining men were the guests of the Commercial Club during the forenoon. In the afternoon a trip was taken to Mascot, to look over the plants of the Aluminum Company of America and the American Zinc Co. The party reached Chicago on Saturday morning.

The new officers of the Lake Superior Mining Institute are: President, C. T. Fairbairn, Birmingham, Ala.; vice presidents, W. D. Calverley, Houghton, Mich., and M. E. Richards, Crystal Falls, Mich.; managers, A. D. Chisholm, Ironwood, Mich., Edward S. Grierson, Calumet, Mich., and B. W. Batchelder, Nashwauk, Minn.; treasurer, E. W. Hopkins, Commonwealth, Wis.; secretary, A. J. Yungbluth, Ishpeming, Mich.

The following resolutions were adopted:

First: Greetings were sent to Dr. N. P. Hulst, of Milwaukee, the first president of the Institute, who recently celebrated his 75th birthday.

Second: That the Institute, an organization composed of more than 500 members, in annual convention assembled, declared it to be the deliberate judgment that the Congress of the United States should without delay provide by law for universal military training and universal compulsory military service in our army and navy, along the lines recommended by the General Army Board, and that the President should sign and put into execution such a law."

Third: A resolution was devoted to extending thanks to the Birmingham committee, the various companies engaged in mining and metallurgical pursuits in the district, and especially to Edwin Ball and C. T. Fairbairn, who had charge of most of the entertainment, and to the others in Birmingham and Chattanooga who had done so much to make the stay of the Northerners a pleasant one.

Listing of Aluminum Supply

The British Minister of Munitions has issued an order, under date of Feb. 17, 1917, according to the *Board of Trade Journal*, Feb. 22, 1917, requiring all persons to send in to the Director of Materials, London, in the first seven days of each month, commencing in March, monthly returns of: All aluminum held by them in stock or otherwise under their control on the last day of the preceding month; all aluminum purchased or sold by them for future delivery and not yet delivered on such last day, together with the names of the sellers to or purchasers from them; all aluminum delivered to them during the preceding month; all aluminum scrap or swarf produced by them and (or) issued from their works during the preceding month; and all contracts or orders existing on the last day of, or entered into during, the preceding month requiring for their execution the use of aluminum, specifying the purposes thereof.

Notwithstanding this order, no return is required from any person whose total stock of aluminum in hand and on order for future delivery to him has not at any time during the preceding month exceeded 56 lb.

For the purpose of this order the expression aluminum shall mean: Aluminum and alloys of aluminum, unwrought and partly wrought, including ingots, notched bars, slabs, billets, bars, rods, tubes, wire, strand, cable, plates, sheets, circles, strip; aluminum scrap and swarf, aluminum alloy scrap and swarf, remelted aluminum scrap and remelted aluminum alloy scrap and swarf; and granulated aluminum, aluminum powder, "bronze," "flake" and "flitter," or any of these.

Attention is drawn to the fact that under the order made by the Minister of Munitions on Dec. 2 last, whereby regulation 30 (A) of the Defense of the Realm Regulations was applied to aluminum, as herein defined, all dealing, or negotiations for dealing, in aluminum, without a permit as specified in that regulation, is illegal and an offense against the Defense of the Realm Regulations.

Pacific Northwest Mining Station

The Pacific Northwest Mining and Metallurgical Experiment Station, Bureau of Mines, Department of the Interior, has been organized and has commenced work on its various problems. The personnel of the staff consists of Dorsey A. Lyon, metallurgist and superintendent of station; George W. Evans, coal-mining engineer; Francis C. Ryan, electrometallurgist; Harlan A. Depew, chemist, and Union B. White, clerk. Superintendent Lyon, in outlining the work for this station, said:

At present the majority of our metallurgical processes are carried out in some type of combustion furnace, which means that carbon in some form has to be burned. Therefore, the widening of the scope of those metallurgical processes in which the electric current is used, either for its thermal effect or for the electrodeposition of metals, means that our coal and oil resources will be conserved, for one of the greatest resources of the country is its water power. Therefore, one of the principal lines of investigation that will be taken up at the Pacific Northwest station will be a study of electrometallurgical processes. Another line of investigation that will be taken up in connection with the work of the station at Seattle will be a study of the methods used on the Pacific Coast for mining coal, with the idea of devising ways and means of preventing waste.

It is hoped, with the help and coöperation of the coal operators of the State of Washington, to install a coal-testing laboratory that will facilitate investigations on the beneficiation of the low-grade, and at present practically valueless, coals found in the Pacific Northwest States. It is also hoped that ways and means may be found for taking up coöperative work with various industrial concerns, and with the department of mechanical engineering of the University of Washington, as regards the proper utilization of low-grade coals and of those coals which may be beneficiated as a result of washing, etc.

As a part of its work the bureau has entered into a coöperative agreement with the University of Idaho, whereby an ore-dressing experiment station is to be established at Moscow, Idaho, and coöperative work carried on with the mining and metallurgical departments of that university. In this work the problems met with in the treating of lead, silver and zinc ores of the Cœur d'Alene type will receive special attention, as will the problems on ore dressing that may be encountered in other mining districts of the state. Thomas Varley, who for several years has been in charge of the ore-testing work for the Federal Mining and Smelting Co., and who has only recently entered the employ of the bureau, will have charge of the bureau's work at Moscow and will work in coöperation with the departments of mining and metallurgy of the university.

As a part of the coöperative work to be undertaken in Idaho, a survey of the many mining districts of the state will be undertaken during the coming spring and summer, in order to determine what metallurgical problems demand first consideration.

The bureau has entered into a coöperative agreement with the Oregon Bureau of Mines and Geology, whereby it will assist that bureau in dealing with the problems of the mining interests of that state. Will H. Coghill, professor of metallurgy at the Oregon State Agricultural College, will represent the bureau as consulting metallurgist in this coöperative work. One of the first things that will be undertaken in connection with this work will be a grouping of the ores of the various mining districts of the state, for the purpose of determining, as far as may be possible, the suitability of present-day metallurgical process to their treatment and especially as to whether those that have to be concentrated before shipment can be effectively and efficiently treated by the flotation process.

World's Production of Silver

In the *Commerce Reports,* Mar. 16, 1917, issued by the United States Department of Commerce, is given the following estimate of the world's production of silver in 1916, from the London *Statist,* Feb. 24, 1917:

For several years past the output of silver has been quite up to, if not beyond, the world's demand. Mining for silver alone is rare except as to the Cobalt region and some special mines in the United States, Mexico and South America; the greater portion of the silver output of the world in some years is a byproduct obtained from mining for base metals, particularly copper and lead.

In making our estimates as to the world's silver output of 1916, we have not only taken account of the restriction of output of enterprises that mined for silver only, but have also made allowance for the exceptional circumstances governing the output of silver as a byproduct, for we believe that the abnormally high prices received for base metals have in many instances led mining companies to increase their extraction of base metals and thereby reduced the extraction of the silver content of the ore. . . . We have taken these various features into account in our estimates, but the war completely upsets calculations, and we frankly admit that in large measure the figures given partake of the nature of calculated guesses. Our estimate of the world output of silver during 1916 is:

ESTIMATED WORLD'S PRODUCTION OF SILVER, 1916

Countries	Oz., Fine
United States	72,880,000
Canada	25,000,000
Mexico	40,000,000
Australia	9,000,000
Europe	4,000,000
Asia	6,500,000
Africa	1,000,000
South and Central America	19,000,000
Total	177,380,000

The world's production of silver in 1916 was the smallest of the decade ended with that year and fell 48,800,000 oz. short of the output in the record year 1911. The average price received, however, was the highest since 1894. The following table shows the growth in output and the variations in the price of silver since 1861:

GROWTH OF WORLD'S PRODUCTION OF SILVER

Year	United States, Oz. Fine	Mexico, Oz. Fine	Canada, Oz. Fine	Other Countries, Oz. Fine	Total, Oz. Fine	Average Price
1861-1865*	5,800,000	15,200,000	†	14,400,000	35,400,000	.....
1866-1870*	9,800,000	16,700,000	†	16,500,000	43,000,000	.....
1875	24,500,000	19,600,000	†	18,200,000	62,300,000	$1.152
1880	30,300,000	21,200,000	†	23,300,000	74,800,000	1.058
1885	39,900,000	26,900,000	†	24,800,000	91,600,000	.985
1890	54,500,000	33,600,000	†	38,000,000	126,100,000	.966
1895	55,700,000	47,000,000	†	64,800,000	167,500,000	.605
1900	57,600,000	57,400,000	4,000,000	54,600,000	173,600,000	.572
1905	56,100,000	56,600,000	5,900,000	38,700,000	157,300,000	.563
1907	56,500,000	61,100,000	12,800,000	53,800,000	184,200,000	.611
1908	52,400,000	73,600,000	22,100,000	55,100,000	203,200,000	.495
1909	54,700,000	73,900,000	27,800,000	55,700,000	212,100,000	.480
1910	57,100,000	71,400,000	33,000,000	61,400,000	222,900,000	.500
1911	60,400,000	79,000,000	32,700,000	54,100,000	226,200,000	.499
1912	63,700,000	74,600,000	31,600,000	54,400,000	224,300,000	.567
1913	66,800,000	70,700,000	31,800,000	55,200,000	224,500,000	.558
1914	72,400,000	70,000,000	27,300,000	43,900,000	213,500,000	.513
1915	74,900,000	60,000,000	26,000,000	33,000,000	193,900,000	.478
1916	72,900,000	40,000,000	25,000,000	39,500,000	177,400,000	.634

* Average † Included with "other countries."

Saving a Shrinkage Stope by an Electric Blast

By S. Ford Eaton*

SYNOPSIS—Shrinkage stoping became inapplicable to an orebody as it became flatter and caving was substituted in the upper part of the stope. Details of development and charge for an electric blast are given. The stope produced 20,000 tons of ore by this blast which would otherwise have been lost.

In the course of mining a body of copper sulphide ore at the Dairy Farm mine, by the Vantrent Mining Co., Vantrent, Calif., the problem of saving a half-completed stope was solved by an electric blast. Mining is done by shrinkage stoping with no particularly unique features. The area of the ordinary stope is 48 x 35 ft; the former measurement along the strike of the ore lenses, the latter being the average width of minable ore from foot to hanging wall. Beyond this distance on the hanging wall, the ore deteriorates to a mineralized schist of extremely low grade, cut up by stringers of waste, schist or greenstone.

A block of ground to be mined is laid off 118 ft. along the vein and not over 35 ft. wide. Two drifts are run this entire length from the main-haulage crosscut; one cutting into the foot wall to the extent of about one quarter of the area of the face and the other in the ore under the hanging-wall half of the vein. A 10-ft. pillar is left between these drifts (see Fig. 1) which are 8 x 8 ft. over-all. The block is divided into two 48-ft. stopes with a 10-ft pillar at each end, between stopes. Provision is made under each stope for four raises in each drift—one manway and chute raise and three chute raises. The manway and chute raises are in diagonally opposite corners, one from the foot-wall drift and one from the hanging-wall drift. Manway and chute raises are driven 6 x 12 ft., the manway half being within the limits of the stope pillars. Chute raises are driven 6 x 6 ft., with 8-ft. pillars left between raises. This arrangement is shown in Fig. 1. However, the projection is a composite of both drifts. One drift would show one manway only.

Before driving the raises, drift timbering under the pillars between raises is put in, 10 x 10-in. square timber being used for drift sets with 6 or 8 in. round poles for lagging over them. The raises are next driven to a height of 16 or 17 ft., and chutes and first manway sets put in. Starting at each manway, 5 ft. above the backs of the drifts, the first slice of the stope is cut out with Leyners. Thereafter the stope is driven up by regular shrinkage methods, half of the stope and one manway being blasted at a time—this is so that one manway will always be clear. The stopes are either driven through to the level above or a 10-ft. capping is left, depending on conditions above.

The stope in question, No. 4, extends from the 300 to the 200 level, a vertical distance of 100 ft. The dip of the orebody being approximately 60°, the actual height of the stope on the incline is about 115 ft. Incidentally,

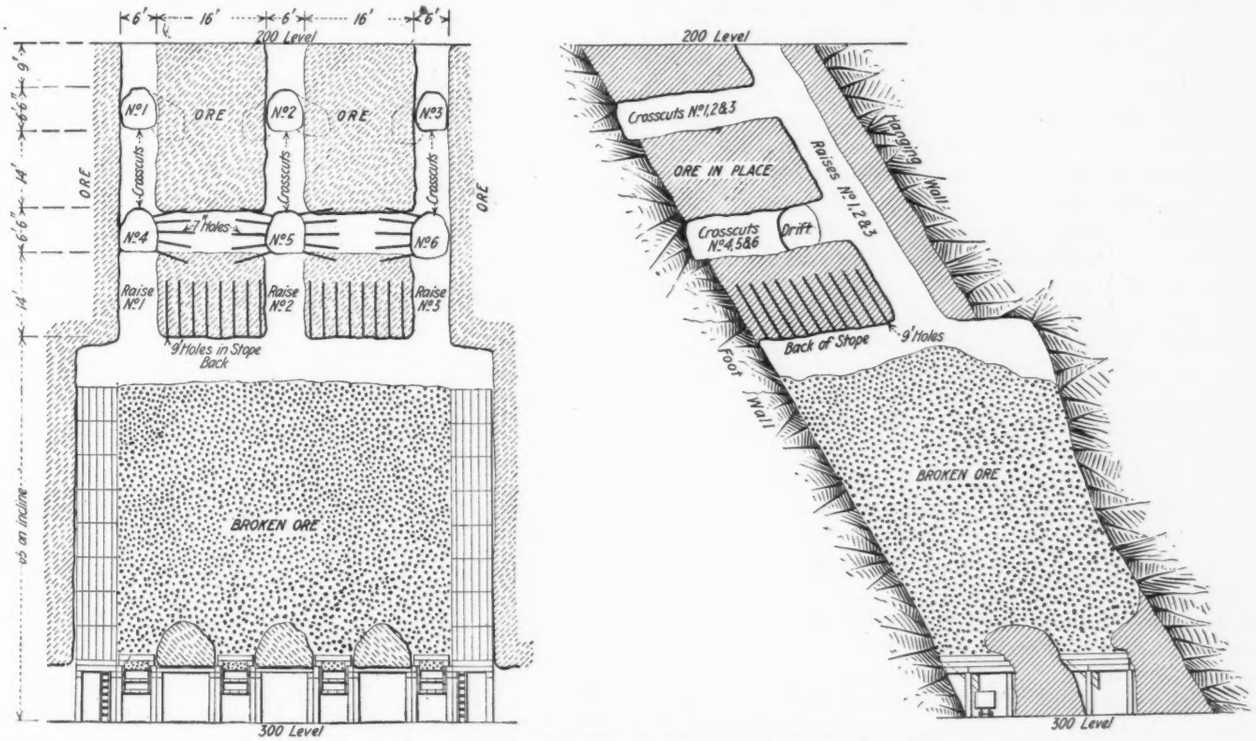


FIG. 1. CROSS-SECTIONS THROUGH STOPE, DAIRY FARM MINE

Lower portion of stope mined by shrinkage stoping and upper portion developed for caving by an electric blast

*Assistant manager, Guamaco Mining Co., Magangue, Colombia, S. A.

all the stoping operations have shown that an orebody with this pitch cannot be mined advantageously, by the shrinkage system, especially with levels so far apart. All levels had been driven before this company undertook the mining of the orebody, hence no reasonable or economical change in the old plan could be made. Another condition was found to exist which further complicated matters. The immediate hanging-wall and foot-wall portions of the ore consist of lenses of varying thickness. These apparently pinch out with height on the hanging wall and "make" on the foot wall. The pinching out and "making" seem to compensate each other, so that the width of the vein continues about the same.

However, as the stope advanced two troublesome features occurred: First, the hanging-wall ore, having been cut out to a definite point by the first slice, the ground broke from there up to a relative dip of 60°. As the back was carried up and the hanging-wall lenses pinched out, it was obvious that it was impossible not to mine waste. Eliminating the extreme hanging-wall holes of successive rounds did not remedy this. While the undesirable portion might hang for awhile, it eventually caved in large slabs, which caused a great deal of trouble at the chutes. The only solution we found was to establish the primary hanging-wall line of the stope 6 or 7 ft. within the known limit of minable ore. Doing this caused some ore to be sacrificed at first, but the amount of waste mined in the upper portion of the stope was materially decreased, particularly if the stope was driven upward as rapidly as possible, and any given portion of the hanging wall not left exposed for an undue period. Second, as the work in the stope progressed, a persistent cutting into the foot wall with flat stoping holes was imperative in order to mine all the ore. The grade of the ore on the foot wall usually being the best, this feature was quite essential. This cutting in after the lenses which are under the foot wall brought the dip of foot wall of the stope to about 55°.

The line of pulling or drawing of the chutes was practically vertical. As the stope advanced at the dip of 55°, it was inevitable that ore accumulated on the foot wall. This could not be lowered without excessive drawing, which pulled the broken ore under the hanging-wall half of the back down so that it was difficult to drill the next round. The alternative was to muck back, and after a stope passed the 50-ft mark the cost of this mucking assumed serious proportions.

The Development of a Block-Caving System

Stope No. 4, between the 200 and 300 level, had been driven to a point 65 ft. above the 300-ft. level, with exceptionally heavy cutting into the foot wall. By this time the cost of mucking was getting too high and the hanging wall was caving waste badly. Not only a large amount of waste and poor ore was coming into the stope, but it was getting extremely dangerous to work in.

Something had to be done, so it was decided to cave the balance of the stope by an electric blast; it being hoped by this means to eliminate all dangerous working conditions, hold the stoping costs down to normal and decrease the amount of waste drawn. By breaking and bringing down this block of ground, it was reasoned that the hanging wall would be held in the place by broken ore, in all probability until the major portion of comparatively clean ore was drawn.

This hanging wall caving being taken into consideration, it was decided to confine, if possible, the immediate breaking effects of the blast to the estimated hanging-wall limit of minable ore. At the time the preparatory work for the blast was commenced, stope No. 4 measured about 45 ft. from foot to hanging wall. In preparing for the block caving, this distance was cut down to 30 feet.

In this plane, 30 ft. from the foot wall, three raises 5 x 6 ft. were driven, holing through into a drift on the 200 level. Upon the completion of these raises, all tools, timber, powder, etc., were lowered from the upper level. Next, six inclined crosscuts were driven from these raises to the foot wall, two from each raise nearly at right angles to the dip of the ore. The plane of the bottoms of the lower three crosscuts was 14 ft. above the back of the stope; that of the upper three, 14 ft. above the first. This left about 8 ft. of ground between the backs of the upper series of crosscuts and the 200 level (Fig. 1).

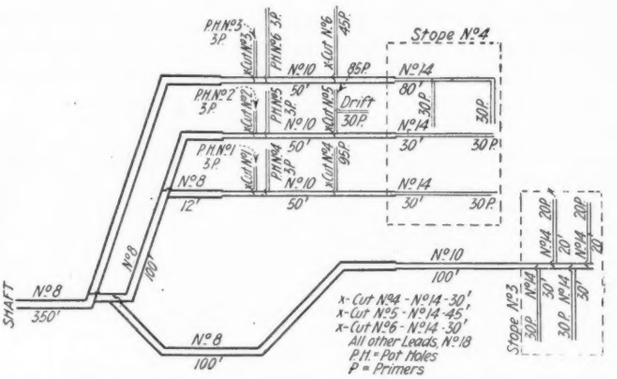


FIG. 2. WIRING DIAGRAM AND DISPOSITION OF CHARGE FOR ELECTRIC BLAST

The three lower crosscuts were connected by a drift—this for accessibility only. In all these operations the ore broken was mucked back and thrown down the raises to the stope. Sufficient drawing was of course done to accommodate this rock.

The problem of powder disposal or placing was thoroughly discussed. Two methods seemed available. The entire block of ground could be drilled and the powder placed uniformly throughout, or the powder could be concentrated in a limited number of "pot-holes." The estimated quantity of powder required was based on the amount regularly used in mining a block of ore this size, plus about 15% for margin. The amount was placed at 5000 pounds.

The method used was a combination of both of the foregoing. The lower half was drilled and the upper half broken by "pot-holes." In the back of the stope 9-ft. holes 4 ft. apart were drilled with stopers over the entire area 48 x 30 ft. (see Fig. 1). The sides of crosscuts Nos. 4 and 6, facing the block, were drilled with rows of five 7-ft. holes 3 ft. apart. Both sides of crosscut No. 5 were drilled in the same manner. The pillar between measuring only 16 ft., this length of hole was considered sufficient. In crosscuts Nos. 1, 2 and 3 six "pot-holes" were cut, two in each—in Nos. 1 and 3 on the sides facing the block, in No. 2 one on the foot wall facing crosscut No. 3 and one 5 ft. from raise No. 2 facing crosscut No. 1. These "pot-holes" were cut with one round of holes, into the face about 6 ft. and down 2 ft. The rock

broken by the last rounds in crosscuts Nos. 1, 2 and 3 and the "pot-holes" was left in these crosscuts and used for tamping over the charges in the "pot-holes." The entire arrangement of powder was made with a view to caving the stope through to the 200 level. Inasmuch as this portion of the mine had been worked out, no harm could be done by so doing.

At about the time No. 4 was in readiness, the adjacent stope, No. 3, had been driven within 20 ft. of the 200 level. It was decided to drill a 10-ft. round of holes in the back of this stope and blast them with No. 4. A raise from No. 3 stope to the 200 level was available for carrying down wires.

Arrangements for Electric Blasting

Wiring was started a few days before loading; that is, main leads and subleads were strung. Loading and complete wiring was started at 6 p.m., June 6, and the blast fired at 9 a.m., June 7. Shifts of 20 men including timbermen, machinemen and muckers, working 8-hr. shifts, accomplished this. All final connecting of primers, subleads and main leads and circuit testing was done by the mine foreman and a shift boss.

As the wiring was completed and the work retreated up the raises, all ladderways were removed by the timbermen. Before the last connections were made underground, all power was shut off at the transformer house and the firing current later thrown in from there. The current used was 2300 volts stepped down to 440 volts. The plan of wiring and division of the load are shown in Fig. 2.

In the stopes, primers were connected in multiple-series of five and six each. In crosscuts Nos. 4, 5 and 6 it was found easier to connect in parallel, each primer direct to the two sublead wires. Three primers were used for the "pot-hole" charges, each placed in a separate box of 60% powder. No. 18 wire was strung from the subleads in the raises to each "pot-hole." These were run through flexible conduit to protect them from the rock banked over and in front of the charge.

Two strengths of powder were used, 40% and 60%. For primers 60% only was used. Bottoms of all drill holes were loaded with 60% and four cases (200 lb.) of the same placed in each "pot-hole" charge. The number of holes, amount of charge, etc., are given in the table.

DISTRIBUTION OF POWDER IN BLAST

Place	Kind of Powder	Amount Lb.
Back of stope No. 4, 120 holes	60%	200
	40%	300
Crosscuts Nos. 4, 5, 6, 260 holes	60%	250
	40%	450
Six-pot-holes, 200 lb. each	60%	1,200
300 lb. each	40%	1,800
Back of stope No. 3, 100 holes	60%	200
	40%	250
500 primers	60%	250
Total		4,900

The estimated amount of ore broken by the blast was about 20,000 tons mine-run. On this basis the cost per ton of that mined by this blast approximated the normal cost. The blast was a complete success, the one drawback being that the stope was held up for a time from production but at a mine operating on a tonnage basis from several producing stopes, this was a minor matter compared with the loss of 20,000 tons of ore, which would have otherwise been the case. This method could be advantageously adopted for shooting and caving stopes under circumstances not as compulsory as in this case.

Tin Output of Siam

According to recently issued official statistics, published in a report of the Department of Commerce, communicated by Vice Consul C. C. Hansen, of Bankok, the total tin output in Siam for the fiscal year ended Mar. 31, 1915, was 14,764,133 lb., out of which 3,958,133 lb. was recovered by dredging; and for the previous year the total amount obtained was 15,114,933 lb., of which 4,003,467 lb. was the result of dredging. Statistical tables further show that Siam's yearly production of tin has slowly advanced since the fiscal year 1908, when the amount obtained by mining was 9,596,133 lb. and dredging gave only 62,111 lb. The average price of tin has increased from 71 Mexican dollars per picul (133⅓ lb.) in 1908 to $95 in 1915.

The mining and dredging for tin is entirely confined to Siam's possessions in the Malay Peninsula, and out of the total production in 1915 of 110,731 piculs in the four mining districts, the district of Puket yielded 98,390 piculs; Patani, 7989; Nakawn Sritamarat, 2025; and Chumporn, 2327 piculs.

From unofficial sources it is ascertained that Siam's total tin exports for the fiscal year ended Mar. 31, 1916, amounted to 20,156,667 lb., exceeding the exports for 1915 by 5,392,533 lb., but it is not expected that this rate of increase will be maintained in the future. Of the total amount of tin exported in 1916, the quantity obtained by dredging was 6,243,880 lb., or 2,285,747 lb. more than in 1915.

Six dredges were operated in the district of Puket and nine in Renong, and a total of over 9,000,000 cu.yd. was excavated, yielding from 0.53 to 1.12 *catty* (about 20 to 40 oz.) of tin ore per cubic yard during 1916.

Government Nitrate Plant

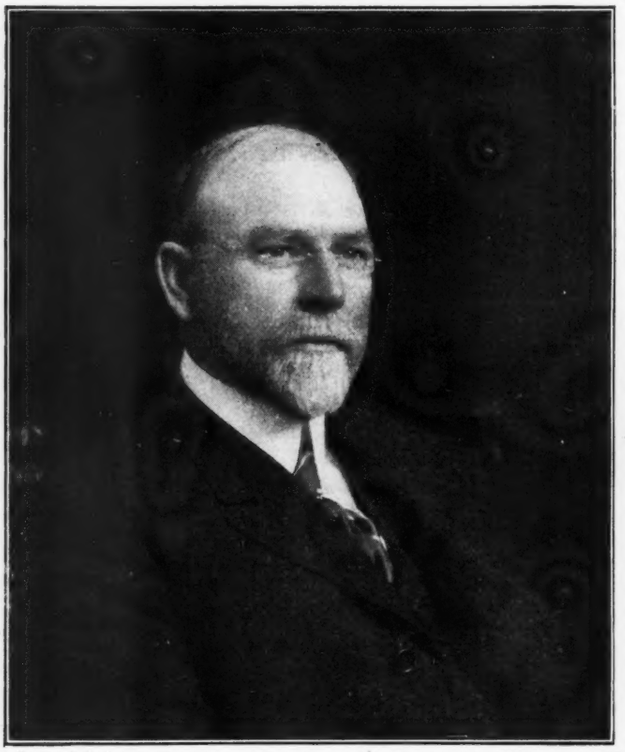
Washington Correspondence

Experimental nitrate plants probably will be established at several points before final decision is made for the location of the large Federal nitrate plant. This course appears probable in the light of the hearings which have just been completed by the interdepartmental board, which is studying the matter of location. George Otis Smith, of the United States Geological Survey, and Charles L. Parsons, of the division of mining technology of the Bureau of Mines, are the members of the board representing the mineral end of the investigation. Other members are the Secretary of the Interior; the Secretary of Agriculture; the Secretary of War; General Black, Chief of Engineers; Colonel Keller, Engineer Corps; Colonel Wheeler, Division of Ordnance; Oscar C. Merrill, Forest Service and J. C. Carruthers, of the Nitrate Experimental Laboratory. Hearings were conducted at Columbia, S. C., Augusta, Ga., Atlanta, Birmingham, Tuscaloosa, Nashville, Louisville and Wheeling, W. Va. In addition the board took a day's trip on the Tennessee River between Decatur and Florence, Ala. A visit also was made to the phosphate-rock locality at Mount Pleasant, Tenn. The board inspected the byproduct ovens and the steel plant at Ensley, Ala. All members of the party expressed themselves as being thoroughly impressed with the richness of the states visited in the mineral resources essential to the establishment of a varied electrochemical industry on a large scale. It is expected that the trip will result in expediting matters before the new Congress.

James H. McGraw

For more than a quarter of a century, James H. McGraw, who has become the President of the McGraw-Hill Publishing Co., Inc., has been a prominent figure in the field of technical journalism.

In the late 80's three young men, who had come to New York City from country towns only a short time previous, were associated in publishing three small journals, called *Power,* the *Street Railway Journal* and the *Journal of Railway Appliances.* The three men were Emerson P. Harris, H. M. Swetland and James H. McGraw. Harris was the pioneer in establishing the



JAMES H. McGRAW

journals, and he brought the other two young men from their homes in western New York first as employees, but later they became partners. In a short time Mr. Harris sold his interest to the other two men and a separation occurred. Mr. Swetland took the journal *Power,* built it up to a commanding position and sold it in 1902 to the Hill Publishing Co. Mr. McGraw retained the other two journals. His choice was fortunate, for the street-railway business was being revolutionized by the introduction of electricity, and the *Street Railway Journal* was a necessity. In 1896 Mr. McGraw bought a journal called *Electrical Industries,* which he renamed the *American Electrician;* three years later he purchased the *Electrical World* and the *Electrical Engineer,* and consolidated the three papers as the *Electrical World.* In 1902 he purchased the *Engineering Record* and about the same time began the publication of a journal devoted to electrochemistry, which since 1915 has been issued under the title *Metallurgical and Chemical Engineering* as a semimonthly. A year ago a journal called *Electrical Merchandising,* was established. Recently two journals in Chicago devoted to contractors' interests were purchased and are now issued by him as *The Contractor.*

Mr. McGraw has always taken an active interest in the industries represented by his journals. He has been especially prominent in the electrical field and is an Associate of the American Institute of Electrical Engineers. He belongs to the Engineers Club, the Railroad Club, the Republican Club and the Aldine Club, in New York City.

E. J. Mehren

The choice of E. J. Mehren, Editor of the *Engineering Record,* for the position of Vice President and General Manager of the newly organized McGraw-Hill Publishing Co., Inc., is a noteworthy promotion of a civil engineer, comparatively young in years, to an executive position of great responsibility.

Mr. Mehren graduated from the civil-engineering course of the University of Illinois in 1906. His first engineering work was on the locating survey of the Chicago, Milwaukee & St. Paul's extension to Puget Sound; but after a few months he came to New York and began work as an associate editor of the *Engineering Record.* After four years he was offered and accepted the position of manager of the Emerson Co., of New York, efficiency engineers. After little more than a year in this new posi-

E. J. MEHREN

tion he was invited to return to the *Record* as its managing editor, and he was made editor-in-chief in 1913.

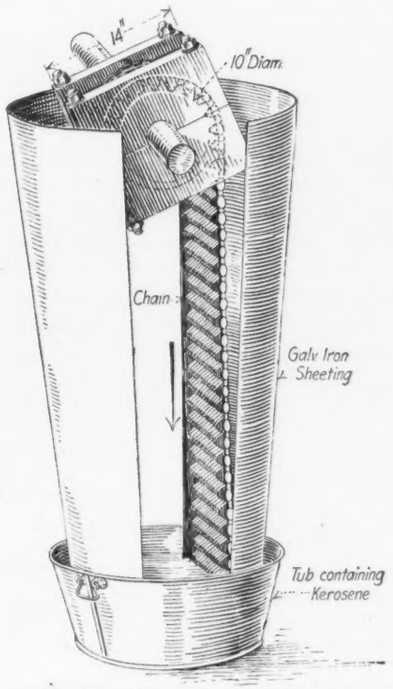
Mr. Mehren's progressive work in his conduct of the *Engineering Record* has made him widely known to the engineering profession. At the close of last year two important executive officers retired from the McGraw Publishing Co. and Mr. Mehren was made vice president of that company. When the recent consolidation of the McGraw company and the Hill company was effected, Mr. Mehren was chosen to weld the two organizations into a harmonious working unit.

Details of Milling and Smelting

A Handy Silent-Chain Cleaner

By A. C. Daman*

At the Tonopah Belmont mill great care is taken of the chain drives. At definite periods and also when being repaired, they are thoroughly cleaned by a method which is quite unique and cheap. The accompanying sketch shows a block pulley made of two ordinary blocks fastened to a slow-moving lineshaft. On this block are hung the long silent-drive chains the lower part of which dip into a bucket of kerosene. The chains are revolved for hours at a time in this manner without attention. This effectually cuts all the grease and grime not only from the exterior, but also from the joints of the chain. This method adds to the life of the gear, besides helping to keep the operation smooth and noiseless.



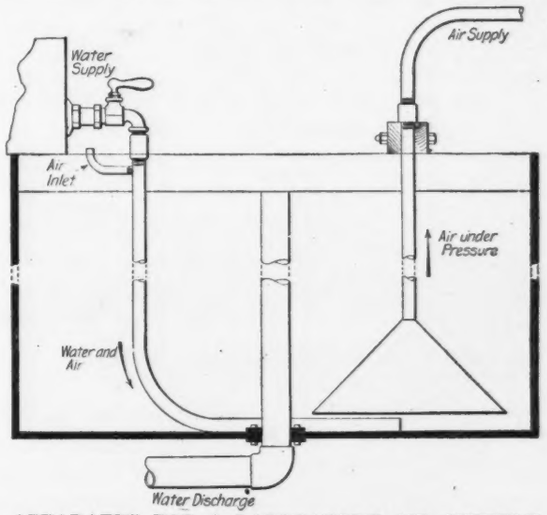
AN EASILY MADE CHAIN CLEANER

Air Supply for Laboratory Tests

By A. W. Allen†

Even where available, a normal air-pressure service is not suitable for small-scale tests. An arrangement for such purpose that can be put together in a few minutes and can be used with an ordinary sink is illustrated herewith. A pipe is fixed in the discharge as shown, and serves to raise the overflow level of the water in the sink as high as necessary. A length of rubber hose is connected with the water supply and a piece of bent glass tubing let into this to supply the air. An inverted glass funnel is used to collect the air, and rubber tubing carries the supply to the experimental plant.

The pressure of air can be regulated, subject to available water supply, by the depth of the funnel in the sink or box used. An advantage in the use of such a system in small-scale hydrometallurgical tests is that cool and moist air is used and excessive evaporation of the test avoided. Also, the pressure cannot rise above a determined maximum.

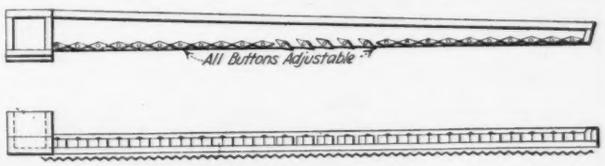


APPARATUS FOR A LABORATORY AIR SUPPPLY

A Dressing-Water Board

By E. J. O'Connell*

A dressing-water arrangement for concentrating tables that has recently been developed and perfected has several advantages over the dressing-water box suspended above the table deck that has been so long in use. Where dressing water is largely made up from the overflow from settling tanks or thickeners, it has a special advantage. The board is flush with the outlets and being fastened to the splash board shakes with the table, making it self-cleaning. The stationary water box usually becomes a settling basin for solid matter, clogging up the outlets. Such a condition prevents the uniform flow of dressing water that is so desirable. The success of this new dressing-water board lies in its varying widths and lateral and longitudinal inclines.



CONCENTRATOR DRESSING-WATER BOARD

*Mining engineer, 2678 Eudora St., Denver, Colo.

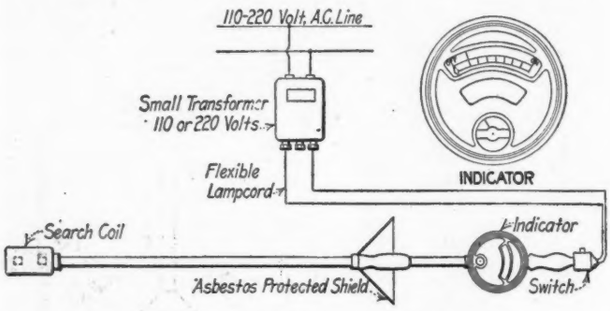
†Metallurgical engineer, 309 Broadway, New York.

*The Deister Concentrator Co., Fort Wayne, Ind.

Mining and Metallurgical Machinery

Critical-Temperature Indicator

The following illustration shows an instrument for indicating the presence of the critical point in steel absolutely. It is a well-known fact that steel in the process of heating loses its magnetic properties when it is brought to



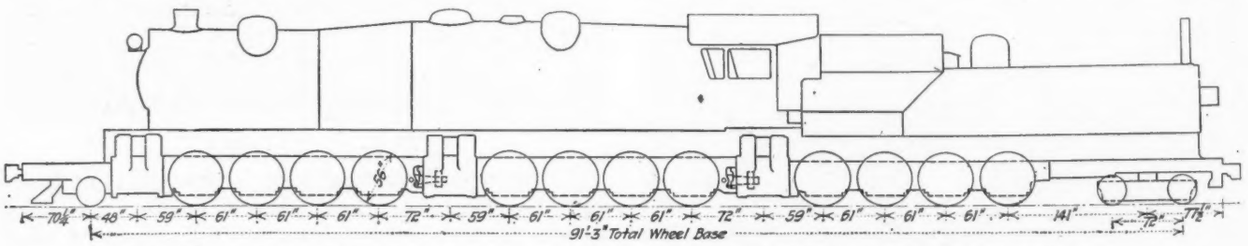
CRITICAL-TEMPERATURE PYROMETER

its critical point. The pyrometer known as the "Crit Point," which is a product of the Gibb Instrument Co., of Pittsburgh, Penn., takes advantage of this phenomenon. Through the medium of magnetic coils, contact is made with the steel in the furnace. A magnetic indicator is placed in the circuit, and the meter immediately indicates through the loss of magnetism when the steel has reached its critical point.

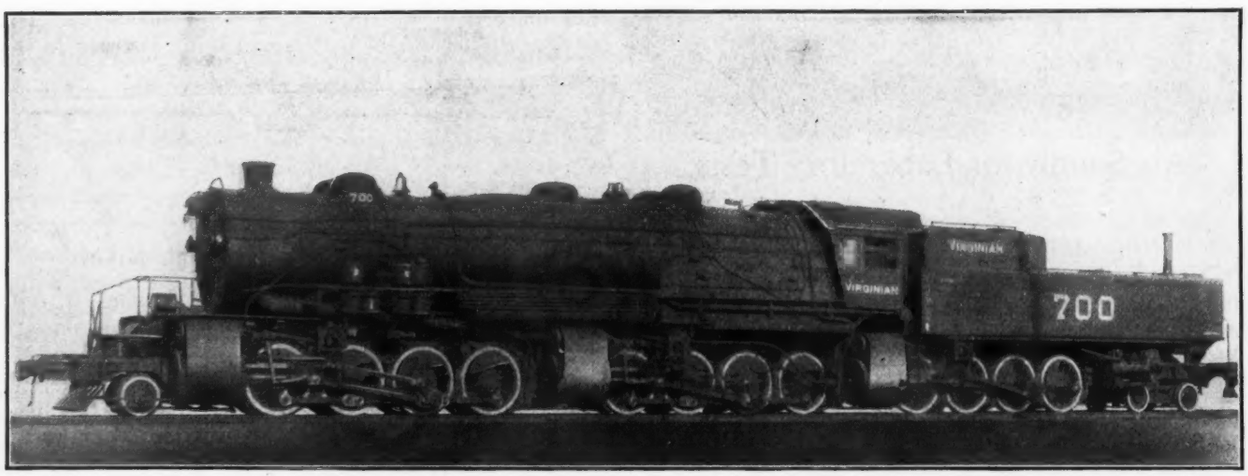
World's Greatest Steam Locomotive

A new record in size and capacity of railway locomotives has been made by the triple articulated 422-ton freight locomotive patented by George Henderson and built by the Baldwin Locomotive Works for the Virginian Ry. As shown in the accompanying illustrations from *Engineering News,* it has a 2-8-8-8-4 wheel arrangement. The maximum tractive effort of this locomotive is 166,300 lb. It has a height limit of 16 ft. 10 in. and a width limit of 12 ft. at a height of 2 ft. 3 in. above the rail. The center line of the boiler is 10 ft. 9 in. above the rail. The rigid wheel base is 15 ft. 3 in. and the total wheel base 91 ft. 3 in.

The Virginian locomotive has a third set of cylinders and driving wheels under the locomotive tender, all cylinders of the same size with the two center cylinders taking high-pressure steam and discharging to the end pair of cylinders working on lower pressure, a huge superheater, a feed-water heater on the tender, etc. Flanged tires are used throughout, the lateral play between flanges and rails being $\frac{1}{8}$ in. on the front and back drivers of each group, and $\frac{5}{8}$ in. for the main and intermediate pairs. Since the railroad has no turntable capable of taking this unit, it is turned on Y's laid out with a curvature of 18°. The three groups of driving wheels carry approximately equal loads (60,500 lb. per axle). The weight of the overhang on the tender is carried by a four-wheeled



SKELETON ELEVATION OF TRIPLE COMPOUND LOCOMOTIVE, SHOWING WHEEL SPACING

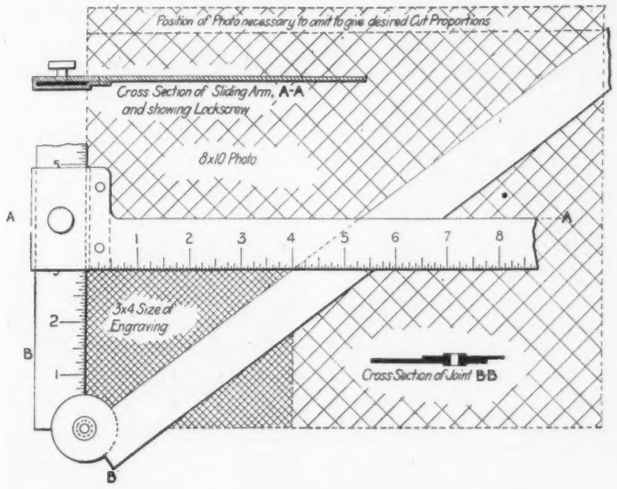


THE LARGEST STEAM LOCOMOTIVE IN THE WORLD

constant-resistance engine truck. This has a total swing of 13¾ in. and carries a load equal to that of an express passenger locomotive of 30 years ago—82,000 lb. The locomotive has a tank capacity of 13,000 gallons, and a fuel capacity of 12 tons.

Measuring and Calculating Scale

The accompanying illustration shows a proportional scale consisting of a horizontal sliding arm on which is mounted a lock screw and two swinging arms held together by a small eyelet. It is used for solving problems that involve proportion, and is operated by laying the scale

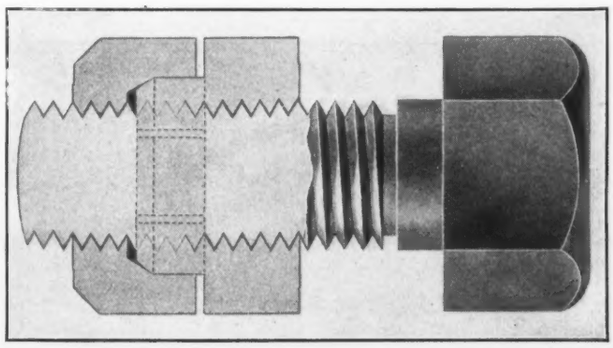


SCALE FOR MEASURING AND CALCULATING

on a desk or table and manipulating the two sliding arms. It is designed particularly for those who have to solve numerous problems involving proportion. It is being placed on the market by W. E. Meadwell, Ithaca, N. Y.

Improved Locknut

The locknut illustrated is one of the latest forms that has been placed on the market. The nut consists of two parts. The lower half is provided with a cylindrical-shaped projection the extreme end of which is machined

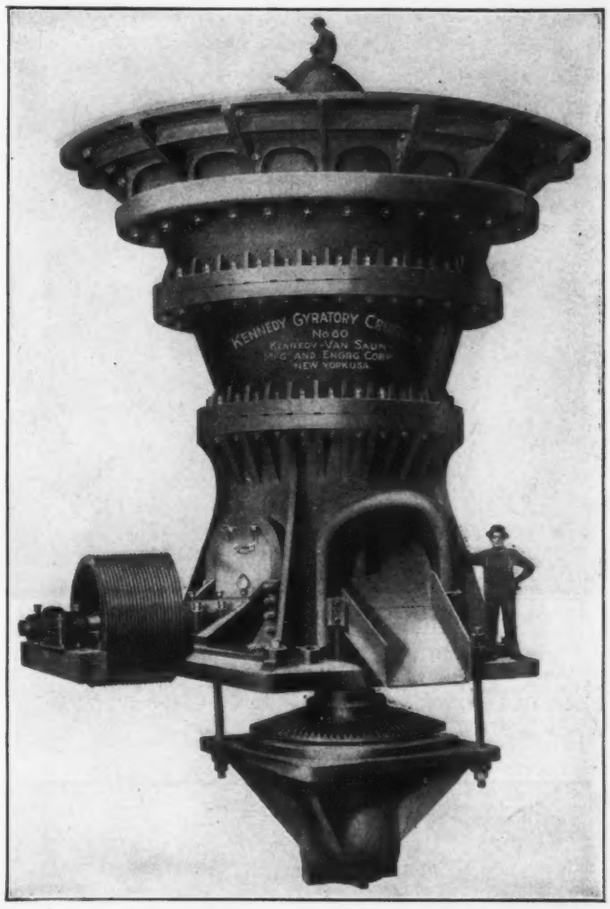


AN IMPROVED FORM OF LOCKNUT

to the shape of a truncated cone. The whole projection is divided into six fingers by means of three cross-slots, in a manner somewhat similar to that used in making castellated nuts. The under side of the upper half, or locking part, of the nut is machined to fit over these six fingers as shown. On screwing the nut down the fingers are squeezed inward, firmly locking the lower half of the nut to the bolt. The Drake Locknut is manufactured by the Western Screw and Locknut Co., San Francisco, Calif.

The Largest Gyratory Crusher

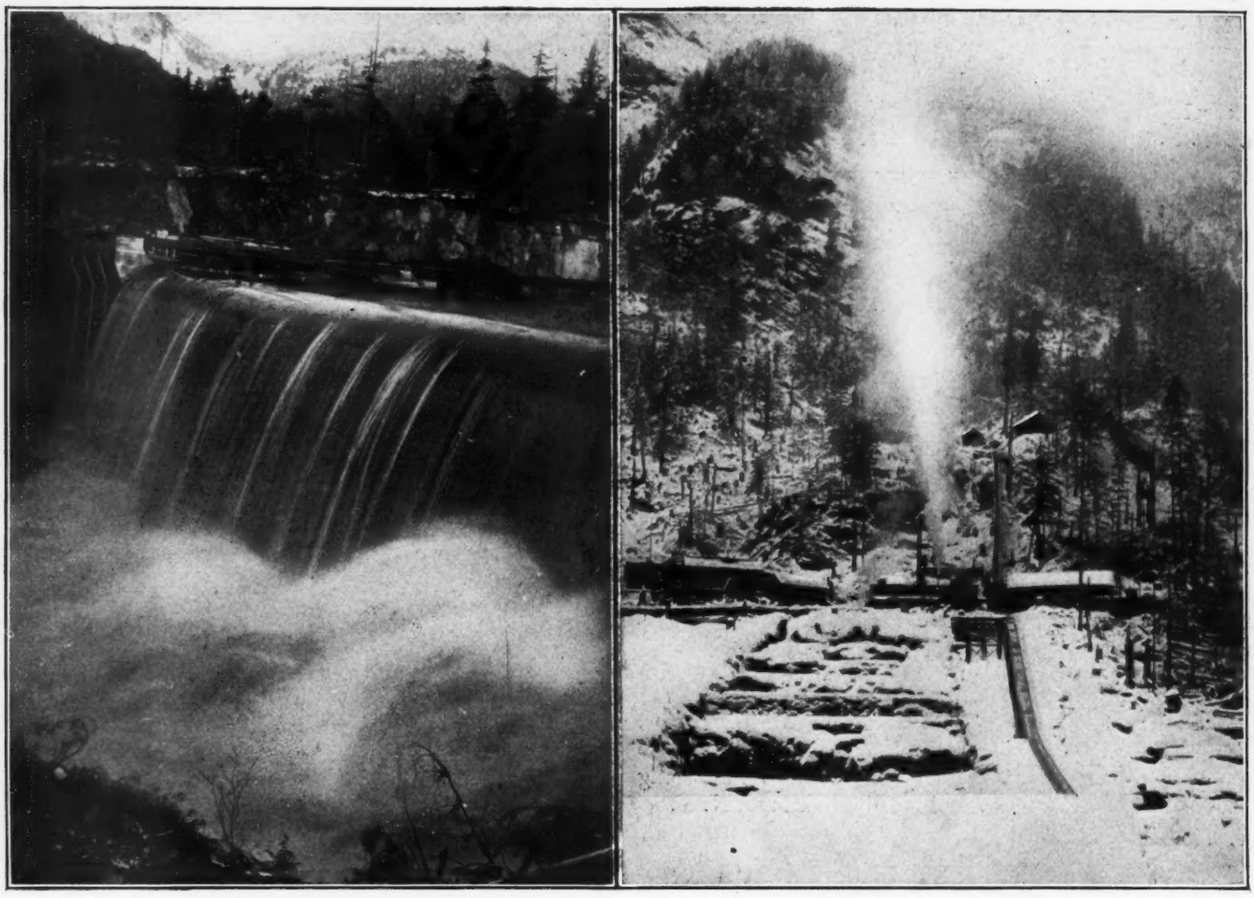
The largest gyratory crusher ever constructed is installed at the plant of the Michigan Limestone and Chemical Co., Calcite, Mich. The machine is a No. 60 Kennedy gyratory breaker, made by the Kennedy-Van Saun Manufacturing and Engineering Corporation, New York, and has a capacity of 25,000 tons per 20-hour day, crushing from 60½-in. down to about 8-in. and finer. The crushing space between the head and concaves holds 30 tons of rock, and this, together with the hopper which flares out above the head, with an outside diameter of about 22 ft., affords a receptacle holding 65 tons.



WORLD'S LARGEST ROCK BREAKER

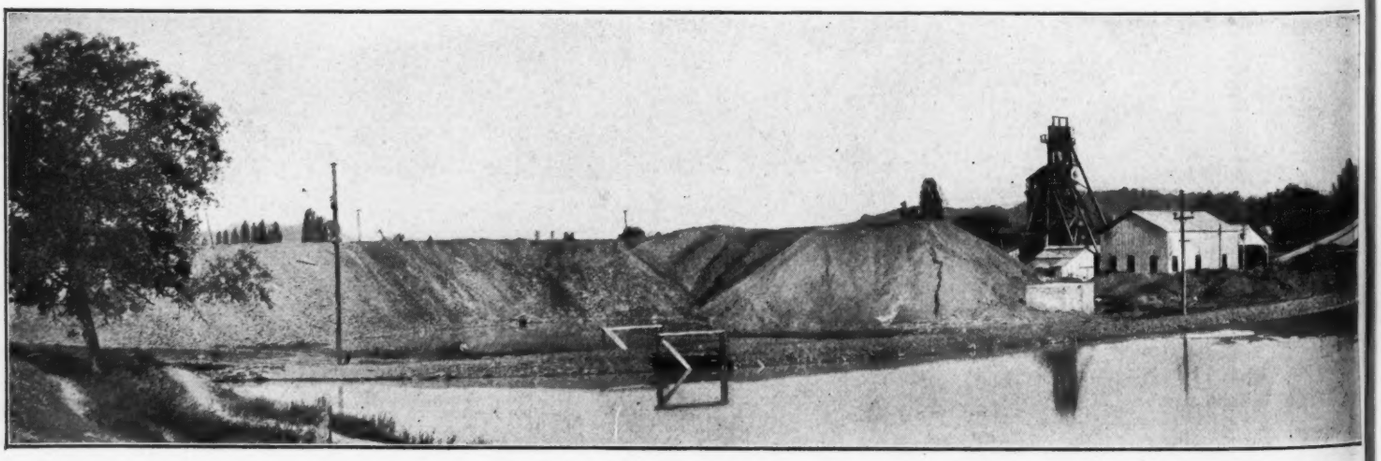
The design of this unusual machine naturally involved much careful study, with regard not only to its operating features, but also to its manufacture and transportation. For instance, its spider, which is made in a single casting, came within one inch of the height limit permitted by railroad regulations, when shipped in a well-bottom car. The main shaft is about 3 ft. diameter at its largest portion and about 28 ft. long. The total height of the machine is 34 ft. It is driven with 1¼-in. manila ropes by a 66-in. cast-steel sheave having 18 machined rope grooves. It is driven by a 300-hp. motor, which has been found ample for the requirements.

Photographs from the Field



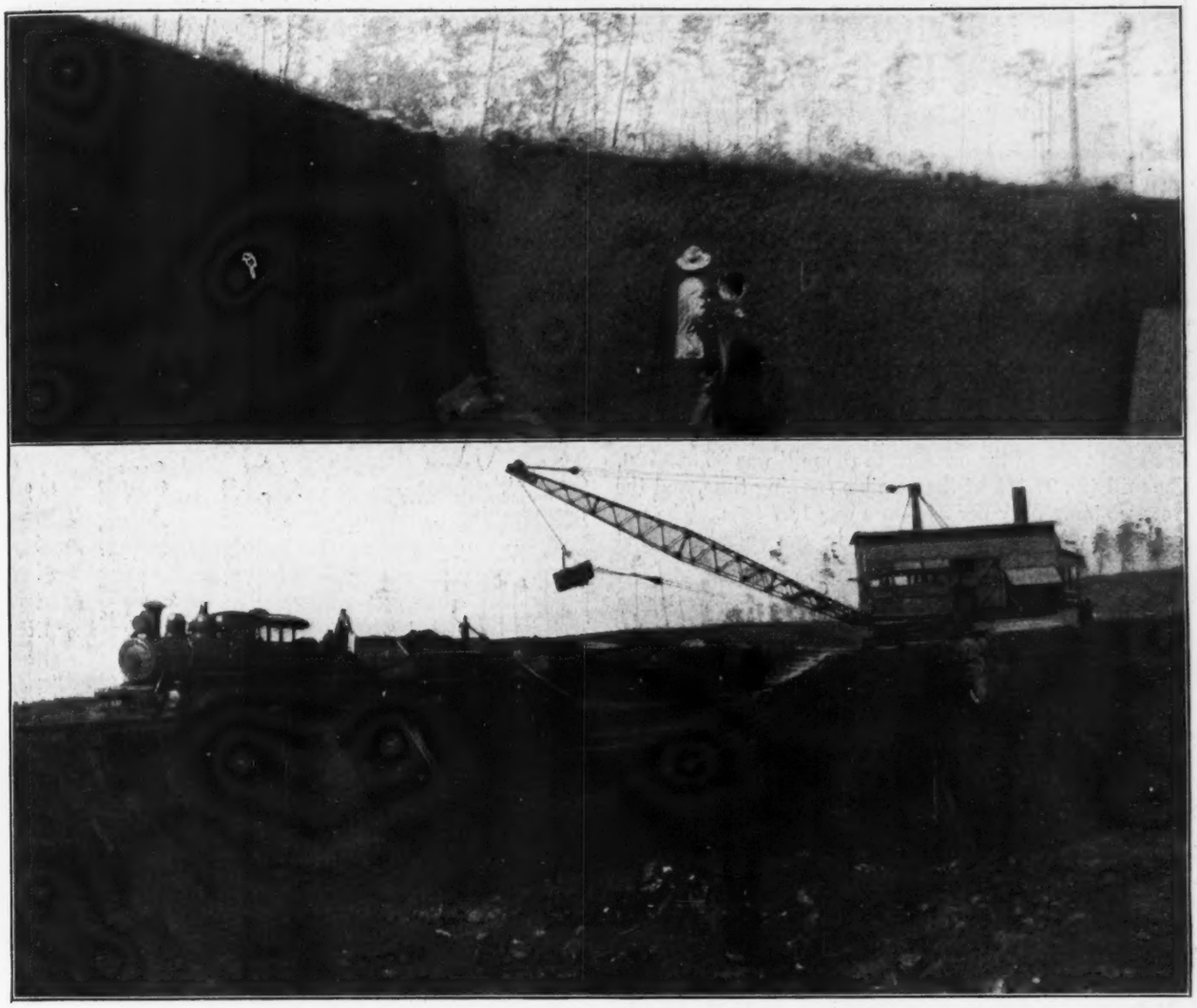
TONOPAH BELMONT'S NEW GOLD MINE AT SURF INLET, BRITISH COLUMBIA

The Surf Inlet mine of the Tonopah Belmont Development Co. is on Princess Royal Island, 7½ miles from tidewater. View at left shows the hollow, concrete dam built to provide hydro-electric power and also to raise the lakes for water transportation to the mine. View at right shows mine and mill site; old mine camp buildings; grading for mill, as of Dec. 10, 1916; No. 3 mine tunnel in background



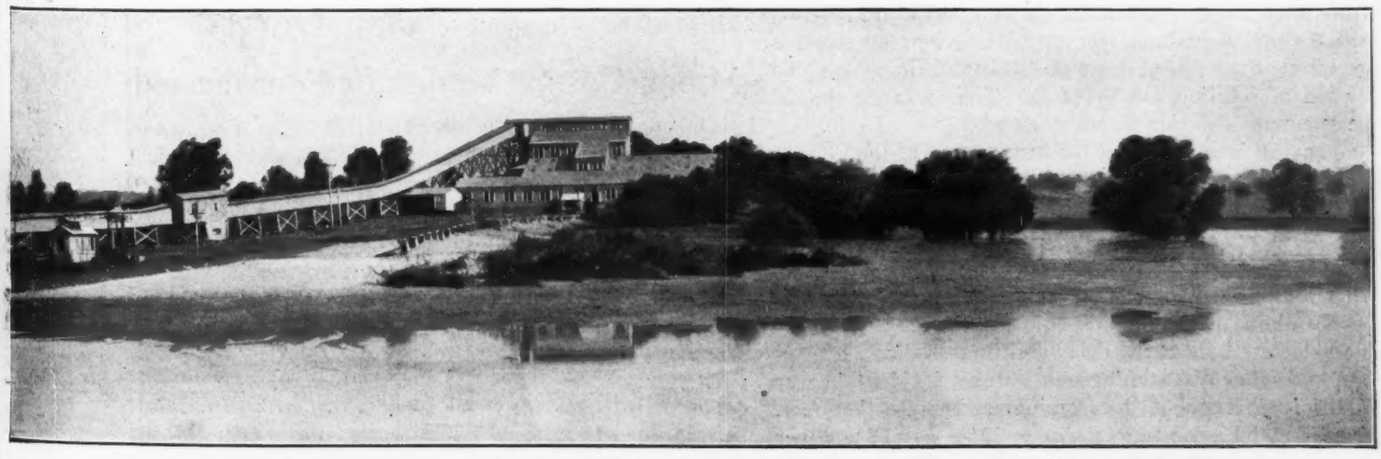
NEW HEADFRAME AND MILL OF PLYMOUTH CONSOLIDATED

This old Mother Lode producer, after lying idle about 30 years, was reopened by a British company on the recommendation of W. J. Loring. It has been yielding steadily since August, 1914, when the new works were placed in operation, following unwatering and exploration in the old mine; the main shaft is vertical for about 1600 ft. and inclined to the



MINING MAYARI IRON ORE, PROVINCE OF ORIENTE, CUBA

Two views at the mines of the Spanish-American Iron Co. in the Mayari district. The firmness of the bank is illustrated by the nearly vertical face in the upper view, and in the lower view by the proximity of the locomotive to the edge of the bank, which is about 25 ft. high. The Mayari district, which is about 15 mi. from the sea, is the only one of the northern iron districts of Cuba that is active; the Moa district, about 40 mi. to the east, and the Cubitas or San Felipe district, about 160 mi. northwest, have not been exploited commercially. The Mayari ore, which contains a large amount of water (25% absorbed and 14% combined), is beneficiated in nodulizing kilns and shipped from Nipe Bay to the United States. These operations are now controlled by the Bethlehem Steel Co.



GOLD MINES, LTD., AT PLYMOUTH, AMADOR COUNTY, CALIFORNIA

2450-ft. level, and is to be sunk 300 ft. farther. About 11,000 tons are milled monthly for a yield of about $55,000. Since reopening the mine has produced over $1,750,000. Its success has stimulated the opening of a number of other old gold mines in California

The Cost of Doing Things

Milling Results at the Hollinger Plant

The milling record for the year at the Hollinger plant, Timmins, Ont., has been satisfactory as was expected, although various factors caused the tonnage treated to be somewhat less than had been anticipated. During the year additions to the mill were completed and the tonnage treated per month gradually increased from 43,000 to 50,000 tons. A total of 610,854 tons was milled, 1649 tons per day, having an average value of $8.84 per ton. The total value of the ore sent to the mill was $5,322,726. The mill ran 91.1% of the possible running time, and the average stamp duty per 24 hours was 16.7 tons. The unrecovered values included $7367 in concentrates stored

DISTRIBUTION OF MILLING COSTS

Account	Labor	Stores	Per Ton Ore Milled
General milling charges	$8,101.16	$6,611.12	$0.024
Superintendence	15,224.20	.....	.025
Tailings disposal	2,099.64	5,767.85	.013
Heating	5,134.70	13,745.04	.031
Lighting	591.07	3,566.87	.007
Mill power plant	3,137.04	1,983.59	.009
Shoveling in bins	6,164.72	.....	.011
Crushing	17,613.95	23,863.25	.069
Conveying	17,986.67	9,082.41	.045
Stamping	15,947.69	44,786.08	.101
Classification and tube milling	19,542.32	83,065.96	.170
Concentration	9,029.27	2,914.51	.020
Treating and handling concentrates	3,681.56	4,952.09	.014
Handling pulp	2,174.08	4,374.07	.011
Thickening pulp	1,047.97	1,484.76	.004
Treating ore and pulp	236.40	53,529.11	.089
Agitation	7,126.59	7,338.43	.024
Continuous decantation	5,924.36	4,415.63	.017
Filtration	8,889.64	10,792.59	.033
Neutralizing	1,297.85	6,500.05	.013
Refining	10,137.32	14,037.11	.040
Clarifying and precipitation	6,468.08	65,625.21	.120
Pumping solutions	4,981.79	6,765.82	.020
Cleaning mill	1,676.85	38.08	.003
Alterations	6,645.44	11,581.00	.030
Ball mill	2,100.55	6,576.28	.014
Assaying	4,382.10	2,164.30	.011
Maintenance of buildings	537.17	19.31	.001
	$187,880.18	$395,580.52	$0.969

for retreatment and $241,958 lost in tailings, making a total of $249,325. The value recovered amounted to $5,073,401.

The consumption of various chemicals has remained about the same as previously, the lime consumed per ton of ore amounting to 2.113 lb., the zinc, 0.405 lb. per ton, lead acetate, 0.0042 lb. per ton. The tons of solution precipitated per ton of ore was 2.221, and the zinc added per ton of solution was 0.182 lb. The average value of the pregnant solution amounted to $3.782. In the accompanying table is shown the distribution of the milling costs, in total and per ton.

Mining Costs at Hollinger

The annual report for 1916 of the Hollinger Consolidated Gold Mines, Ltd., Timmins, Ont., goes into considerable detail about the delay and increased cost of supplies and other disadvantageous features incident to war conditions throughout the Dominion. Despite that fact, however, total operating costs in 1916 were $4.03 per ton, as against $3.98 per ton in 1915. The reason for the small difference of cost is attributed to the advantages due to consolidation of the different properties, which led to economies that offset to a large extent the additional expense due to increased cost of supplies and inefficient labor. The report states that it is hoped the working costs will be from 40 to 50c. per ton below present figures when normal conditions are again restored.

This is another case of a mining company which, for one reason or another, despite most disadvantageous circumstances in all operating conditions did not suffer materially increased costs per ton. In addition, the Hollinger has not had the advantage of high metal prices but, like other gold producers, gets only the fixed normal rate per ounce.

MINING COSTS

Account	Labor	Stores	Total Per Ton Ore Milled
General mining charges	$10,513.22	$7,884.52	$0.031
Superintendence	35,783.04	7.90	.059
Diamond drilling	3,024.43	2,234.79	.009
Crosscutting	16,458.52	22,426.39	.065
Drifting	54,997.31	68,303.48	.205
Raising	10,353.09	11,433.41	.036
Winzes	3,409.45	1,397.62	.008
Timbering winzes	2,322.61	2,154.20	.007
Stoping	230,641.46	259,045.04	.813
Scaling	12,006.55	3.16	.020
Timbering stopes and raises	38,925.77	19,109.39	.095
Retimbering	7,170.57	4,751.50	.020
Back-filling	2,940.27	88.69	.005
Track-laying	13,722.64	6,854.12	.034
Tramming	205,074.44	9,901.26	.357
Pipefitting underground	9,439.65	6,671.32	.027
Mine drainage	6,700.53	8,986.80	.026
Hoisting	34,903.36	16,228.53	.085
Landing and dumping	24,526.67	890.75	.042
Drill repairs	5,864.62	40,167.02	.076
Sharpening steel	29,867.85	11,810.46	.069
Distributing steel	21,623.46	7.27	.036
Mine sampling	9,959.54	84.93	.017
Changehouse	2,738.38	1,582.72	.007
Mine lighting	770.29	8,524.30	.015
Assaying	1,916.12	952.72	.005
Surveying	9,329.50	1,869.91	.019
	$804,083.34	$513,372.20	$2.188

RECAPITULATION OF MINING COSTS

Account	Labor	Stores	Total Per Ton Ore Milled
Exploration	$3,209.86	$2,049.36	$0.009
Development	215,391.03	137,517.79	.586
Production	561,358.53	358,402.97	1.528
Deferred development	5,492.97	3,507.03	.014
Broken ore reserve	18,630.95	11,895.05	.051
	$804,083.34	$513,372.20	$2.188

Mining Costs at Vindicator Consolidated

During the year ended Dec. 31, 1916, the Vindicator Consolidated Gold Mining Co., Independence, Colo., mined 319,197 tons of crude ore; which produced 119,130 tons of shipping ore having an average gold content of $19.271 per ton. The mining costs per ton hoisted were as follows:

Breaking ore	$0.506	Surveying	$0.019
Tramming	.252	Renewals and repairs	.065
Timbering	.267	Sundry expense	.066
Hoisting	.253	Office	.065
Sorting and loading	.197	Superintendence	.095
Pumping	.207	Watchmen	.035
Lighting	.023		
Assaying	.031	Total	$2.081

Chiksan Mining Co., Chosen, reports that for the half-year ended Dec. 31, 1916, the recovery was $12.12 per ton, at a cost of $5.52 per ton, leaving a profit of $6.60 per ton. Total output of gold bullion was 21,817 oz., and of concentrates, 451 tons.

Accurate Silica Determination in Commercial Analysis

By F. G. Hawley*

SYNOPSIS—A discussion of methods of silica analysis with notes on the errors introduced by a variation on the amount, strength, and temperature of acid used in preliminary reduction, and length of time under treatment. The high cost of platinum has led to the introduction of a method using nickel crucibles which is described in detail.

Theoretically, the determination of "true" silica is a simple process, but it is found in commercial analysis that it is frequently a difficult matter to get satisfactory results. With careful work a chemist can usually get duplicate determinations to check within 0.3 to 0.4%, but frequently different chemists will not agree to within 2%. In view of these facts it would seem that chemists should investigate the cause of the errors and adopt some procedure that would at least tend to minimize these divergencies.

In "Bulletin 422" of the United States Geological Survey—"The Analysis of Silicate and Carbonate Rocks"—Dr. Hillebrand describes how an accurate SiO_2 determination can be made, but the method given is not suitable to commercial work where speed is necessary. Dr. Hillebrand and others proved long ago that there were three main sources of error in the method commonly used: A plus error from the small amount of SiO_2 from the flux; another plus error due to impurities retained by the SiO_2; and a minus error due to the solubility of the SiO_2 in the HCl.

In my experience the amount of SiO_2 introduced with the flux usually amounts to less than 1 mg. and a satisfactory correction may be easily made if the flux is measured. The amount of impurity retained by the SiO_2 may vary according to the elements present and to differences in the acid treatment, but generally amounts to between 0.1 and 0.3%. By far the largest and most troublesome error is the one due to the solubility of the SiO_2 in the HCl. This error is much greater than most chemists realize. I have known of several who carefully deducted 0.3 to 0.4% for SiO_2 from the flux and impurities in the SiO_2, but failed to add anything for the SiO_2 lost in solution, which in these instances was about 1.7%.

Dissolving of SiO_2 in HCl

According to my observations the amount of freshly precipitated SiO_2 that dissolves in HCl, depends on the following conditions: First, the amount of acid present; second, the strength of the acid; third, the temperature; and fourth, the length of time the silica is in contact with the acid. There may be other conditions governing the solubility of SiO_2 in HCl, but these seem to be the principal ones. By far the most important is the amount of acid used.

Most chemists use acid of about the same strength to treat the dehydrated silica, and the assays are brought to a boil, insuring the same temperature, and are boiled for a fairly uniform length of time. Few, however, consider the importance of using a definite amount of acid. It seems to be a prevalent idea that the amount of silica dissolved by the acid solution is proportional to the amount of SiO_2 in the sample. When a small bulk of acid is used, this is certainly not the case. The experiments shown in Table I prove clearly that when a small amount of SiO_2 is present, the amount dissolved is proportional to the quantity of acid solution present and not to the amount of SiO_2 in the sample. These experiments were made on the standard sample of argillaceous limestone issued by the Bureau of Standards, which contains, according to the analysis made by Dr. Hillebrand and Dr. Waters, 18.15% of SiO_2.

One-half gram samples were fused in platinum dishes with sodium carbonate dehydrated at 140° C., and run in the ordinary way except that varying amounts of 60% HCl were used. All were boiled five minutes, filtered, and the filtrate evaporated a second time to recover the SiO_2 dissolved.

Solubility of SiO_2 in HCl with Varying Amounts of Acids

TABLE I.

No.	HCl Used, C.C.	SiO_2 on Filter, %	SiO_2 from Filtrate, %	Impurity in SiO_2 %
1	10	17.90	0.28	0.12
2	20	17.78	0.48	0.10
3	30	17.58	0.60	0.10
4	50	17.02	1.16	0.12
5	70	16.52	1.60	0.08
6	100	16.12	2.04	0.08

This experiment has been repeated many times by different chemists and always with similar results. Some textbooks recommend using 50 to 100 c.c. of dilute HCl to dissolve the bases, but do not intimate that as much as 2% of SiO_2 may be dissolved from a sample that contains less than 20%, as shown in Table I.

Much light is thrown on this subject by the following experiment, in which different weights of an ore containing 70.8% SiO_2 were assayed in the usual way. The samples were all boiled two minutes with 10 c.c. of 60% HCl. The other conditions were the same except for the varying amounts of ore.

Solubility of SiO_2 in HCl with Varying Amounts of Ore

TABLE II.

No.	Sample Weight, Gram	Calculated SiO_2 in Sample, Gram	SiO_2 on Filter, Gram	SiO_2 from Filtrate, Gram
1	0.5	0.3540	0.3528	0.0014
2	0.5	0.3540	0.3516	0.0016
3	0.2	0.1416	0.1405	0.0015
4	0.1	0.0708	0.0696	0.0015
5	0.05	0.0354	0.0342	0.0013
6	0.02	0.0142	0.0136	0.0010
7	0.01	0.0071	0.0070	0.0008

This experiment has also been repeated several times with similar results and proves that the amount of SiO_2 that goes into the filtrate is almost constant and in no way proportional to the amount contained in the sample. This does not hold entirely true with samples containing less than 30 to 40 mg. of SiO_2 or when excessive amounts of acid are used.

The fact that nearly the same amount of SiO_2 is lost in the filtrate from a sample containing 10% as from

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one containing 70% naturally leads one to inquire why it does not all dissolve when present in very small amounts, or how SiO_2 that has once gone into the filtrate can be recovered by a second evaporation. The following seems to be at least a partial explanation: When the solution containing silica is evaporated, it precipitates as small flakes. As soon as the hot acid is added, these begin to dissolve very slowly. In samples containing 10% SiO_2 or more, the relatively large number of flakes, presenting a correspondingly large surface to the action of the acid, will quickly saturate it; consequently no more can dissolve from a high-grade sample, than from one containing about 15%. On the other hand, when the sample contains but little silica, there will be but few flakes and the rate of solubility of these will not be sufficiently rapid to saturate the solution in the ordinary time taken for a determination. From this it must follow that when very small amounts of SiO_2 are to be determined, the acid solution should not be boiled longer than necessary.

To prove that the length of boiling has an influence on the results the experiments referred to in Table III were made, 0.5 gram of ore containg 24.1% of SiO_2 being used in each case.

EFFECT OF VARIATION IN TIME OF BOILING

TABLE III.

No.	25% HCl C.C.	Boiled, Min.	SiO_2 on Filter, Gram	SiO_2 from Filtrate, Gram
1	70	1	0.1146	0.0050
2	70	2	0.1138	0.0054
3	70	4	0.1130	0.0068
4	70	10	0.1120	0.0090
5	70	20	0.1117	0.0092
6	15	1	0.1182	0.0020
7	15	2	0.1186	0.0020
8	15	5	0.1188	0.0018
9	15	12	0.1194	0.0016

These experiments demonstrated that when there is considerable volume of acid solution, some time is needed to saturate it, and consequently the length of boiling time is of considerable importance. On the other hand, with only a small amount of acid solution it very quickly becomes saturated and so the length of time it is boiled, is of less consequence. If boiled long enough, the solution may concentrate to such an extent that the dissolved SiO_2 will begin to reprecipitate. This is indicated in the last two experiments shown in Table III.

Table IV gives the results of experiments made to see what effect a variation in the strength of HCl would have on solubility. The results were rather surprising, as it was found that HCl of 15 to 25% strength would dissolve much more SiO_2 than stronger acid.

In each experiment 75 c.c. of acid was used and boiling was continued for five minutes.

EFFECT OF VARIATION IN STRENGTH OF HCL

TABLE IV.

No.	HCl %	SiO_2 on Filter, Gram	SiO_2 from Filtrate, Gram
1	80	0.1199	0.0030
2	40	0.1142	0.0064
3	25	0.1110	0.0095
4	15	0.1112	0.0095
5	8	0.1140	0.0060
6	4	0.1160	0.0054
7	1	.....	0.0038
8	0.5	.....	0.0022

The SiO_2 from experiments 7 and 8 was too badly contaminated with iron to weigh. From other experiments it was found that pure water has a very slight solvent action on SiO_2, which is greatly increased by the presence of NaCl. Considerable NaCl is always present from the action of HCl on the flux, and part of the solubility shown in these tests is undoubtedly due to this cause.

In a further series of tests (Table V) hot acid proved to be more effective in dissolving SiO_2 than cold. Stirring also affected the result. In these experiments 70 c.c. of 40% HCl was in contact with the SiO_2 for 10 min. Samples 3 and 4 were placed in a water bath containing boiling water and heated as hot as possible.

From the results of this and the previous series of experiments it can readily be seen that adding boiling water to dilute the assay or washing the sides of the casserole should be avoided, as it would be equivalent to using a large volume of hot dilute acid, which would result in an excessive loss. Tests made to determine the most satisfactory temperature and length of time for dehydrating

EFFECT OF TEMPERATURE OF SOLUTION

TABLE V.

	Temperature	SiO_2 on Filter, Gram	SiO_2 from Filtrate Gram
1	Boiled	0.1148	0.0068
2	Boiled	0.1146	0.0066
3	88°C stirred	0.1164	0.0048
4	88°C not stirred	0.1176	0.0040
5	70°C stirred	0.1176	0.0038
6	70°C not stirred	0.1186	0.0028
7	45°C stirred	0.1186	0.0022
8	45°C not stirred	0.1194	0.0020

the SiO_2 indicate that heating to 120° to 150° C. for 30 min. gives satisfactory results. If heated to a higher temperature or for a much longer time, the solubility is slightly decreased but the silica will be contaminated by more impurities. Ordinarily, I find that boiling for three minutes with 15 c.c. of 60% HCl will give about as pure silica as could be obtained by boiling longer or with more or stronger acid.

A source of error not generally known is caused by the silica adhering to the casserole so tenaciously that it is not removed by ordinary rubbing. When the acidified solution is evaporated quite slowly to dryness, the silica has little tendency to stick to the casserole; but if the solution is evaporated rapidly, and especially if it is boiled, considerable silica sticks to the casserole and can only be partly rubbed off. The silica adheres mostly to the side at or near the surface of the liquid and forms a roughened ring. When first used, very little silica adheres to the casserole, but with each repeated usage the ring becomes larger and rougher and accumulates more. To reduce this error to a minimum the casserole should be kept as smooth as possible. To remedy the roughening, which is frequently mistaken for etching of the glaze, watch the casserole and as soon as a slight roughening is noticed, remove it carefully with dilute hydrofluoric acid. Place a spoonful of water in the casserole and then an equal amount of HF and quickly rub with a rubber finger cap or "policeman." As soon as no rough places can be felt, quickly empty out the acid and rinse well. If these operations are carefully done, the glaze is not injured noticeably.

When making SiO_2 determinations on sulphide ores or ores containing much Cu, Pb, Sb or other easily reduced metal that would attack the platinum crucible, it is customary to give the sample a preliminary acid treatment to remove the objectionable metal and then determine SiO_2 on the insoluble residue. The necessity of this acid treatment, together with the high cost of platinum, led to the introduction a few years ago of a new method, using nickel crucibles and a flux of Na_2O_2 + NaOH, and eliminating the acid treatment.

This method is used extensively at a number of the large copper camps of the West. Several years ago I made an extensive series of tests to see how its accuracy would com-

pare with the standard sodium-carbonate method. Many experiments were made on analyzed samples issued by the Bureau of Standards, and many comparative assays were also run by the two methods on regular work. These tests, which were carefully made, proved that with careful manipulation the new method is capable of giving as good results as the longer sodium-carbonate method. Most of the foregoing experiments were run by both methods.

The sodium hydroxide used in the new method reacts with the silica of the ore, forming sodium silicate and water. This water is in the form of steam, and if the fusion is started too hot the escaping steam may cause a slight mechanical loss. This will not happen if care is taken to start the fusion at a very low temperature and to increase the heat slowly.

In either method, after dissolving the melt and acidifying, the flux is changed to NaCl, and as the operations are the same from this point onwards and as the same salts are present in about the same quantity, there can be no difference due to the method.

My own modification of the peroxide method, as used for routine work, is as follows: Weigh 0.5 gram of pulp into a 30 c.c. nickel crucible and add one scoopful (about 4 grams) of flux composed of equal parts of sodium peroxide and sodium hydroxide. Mix the pulp and flux, and if the sample is known to contain over 50% of SiO_2 put on a cover to prevent loss. Fuse at a low temperature, beginning much below redness and increasing very slowly until a dull red is reached. A good way to make the fusion is to set the crucibles in an iron tray having holes punched to accommodate them and constructed so that they are held about half an inch above the floor of the muffle. Introduce the tray with crucibles into the muffle at a low red temperature and fuse for three or four minutes.

The Life of Nickel Crucibles

When the fusions are made as described the nickel crucibles can be used from 20 to 40 times, but if the temperature is too high, or if there is too much sodium peroxide in the flux, they will burn out much quicker.

Remove the crucibles and partly cool; place in 4-in. casseroles, and cover the crucibles with 2-in. watch glasses so placed that a slight opening is left on one side. Through this opening squirt in 2 or 3 c.c. of warm distilled water from a wash bottle. This should start a vigorous reaction between the water and the flux. As soon as the action has somewhat diminished add 3 or 4 c.c. more water and continue to do this until the fused mass is disintegrated. Toward the end the water should be added with enough force to thoroughly stir the contents. If the crucible gets too cold or the water is not hot enough, the action may cease before the melt is loosened from the crucible; and if too hot the contents may boil over. With a little practice the right conditions are readily found. As soon as the action ceases and the crucible is a little over half full, rinse off the watch glass and from a large burette add about 10 c.c. of 60% HCl in small portions so as to avoid too violent reaction; then add 90% HCl until it is in excess. The crucible should now be about full and everything in solution except possibly a little gelatinous silica.

With the fingers or platinum-tipped tongs, remove the crucible, rinse, and place the casserole on the hot plate to evaporate. No harm is done if it boils gently at first When about half evaporated, place the casserole on an iron or aluminum ring so made that the bottom of the casserole is kept about one-quarter inch above the hot plate. These rings are very beneficial in preventing spitting. When the residue has become dry, cover with a watch glass and bake at about 125° C. for 30 min.; remove and when cool add 15 c.c. of 60% HCl and turn about so as to moisten all parts of the residue. Allow to stand a short time and then put on the hot plate, and with cover still on, boil for 3 min. Remove and allow to cool, rinse the sides down with the minimum amount of warm distilled water, and swirl around to loosen any crust still adhering to the sides. The NaCl does not all dissolve, but will readily do so in the wash water.

It is very necessary that the casserole should not be heated after rinsing down the sides with water. After standing a few minutes, transfer the contents to a filter and wash twice with warm water; then once with hot dilute HCl and add a little to the casserole. Rub the sides and bottom of the casserole to loosen any adhering SiO_2 and rinse into the filter. This SiO_2 is ground rather fine by the rubbing and has a tendency to clog the filter, hence it is better to add this after the main portion has been partly washed. Wash the filter twice again with water, place in a crucible, partly dry, and ignite strongly for ten minutes. Weigh the SiO_2 as soon as cool, for it is hygroscopic. A correction is now made for the SiO_2 lost in solution, which under these conditions will amount to about 0.4%. A deduction is made for impurities in the SiO_2 and the SiO_2 from the flux. These gains about balance the solubility loss. Occasional tests should be made to check these losses and gains.

It is evident from the nature of the flux that some special method for preparing and storing it will be necessary. The following has proved satisfactory: Take a half-pound or more of pure dry NaOH and grind up, a few sticks at a time, in an iron mortar so that the largest pieces are no larger than a grain of wheat. The grinding must be done quickly, or the NaOH will absorb moisture. Place it in a wide-mouthed jar and add an equal amount of Na_2O_2 and mix by rotating. A satisfactory jar to use is a small 4-in. straight-sided desiccator with a circular piece of gasket rubber for a cover. The jar should be opened as seldom as possible, but in spite of this precaution the flux will slowly absorb moisture. This moisture reacts with the sodium peroxide, changing it to hydroxide, probably according to the following equation:

$$Na_2O_2 + H_2O = 2NaOH + O$$

From this it will be seen that the H_2O is chemically held and so the flux will still be dry, but the oxidizing power is lost. When such flux is used, the fusions will fail to disintegrate properly when hot water is added. The remedy is to add more Na_2O_2 from time to time.

Pure Zirconium Dioxide is a very valuable refractory material, according to Dr. W. Rosenhain, in the "Journal" of the Society of Chemical Industry, Dec. 30, 1916. Highly purified zirconia is a very valuable material. Crude zirconia (about 75% ZrO_2) falls far short of pure zirconium dioxide in refractoriness, but bricks made of it will resist temperatures up to about 1600° C. It is much improved by removing the iron oxide by treatment with hydrochloric acid. To get the best results it is necessary to shrink the material at a much higher temperature than it would have to stand eventually. Zirconia bricks as purified for optical purposes frit above 2000° C. The cracking of refractory materials is caused by forces involving nothing but determinable constants, and the coefficients of thermal endurance can be worked out, as has been done for glass.

United States Steel Corporation

The report of the United States Steel Corporation for 1916 covers an extremely wide range and there are so many properties and plants covered that individual mention is impossible in a brief review. Since, however, the Corporation is one of the country's principal units in the metal industry, its report is important, and may be considered an index of the state of the iron and steel industry of the United States.

The general balance sheet, condensed, is as follows:

CONDENSED BALANCE SHEET

Common stock	$508,302,500
Preferred stock	360,281,100
Stock subsidiary companies not owned	505,042
Bonded debt, U. S. Steel Corporation	429,464,000
Bonded debt, subsidiary companies	174,007,027
Notes subsidiary companies	24,925,558
Mortgages and purchase money	902,290
Current liabilities	92,942,436
Reserve funds	55,337,108
Appropriated surplus	55,000,000
Undivided surplus	381,360,913
Total liabilities	$2,083,027,974
Property account less depreciation	1,472,623,667
Advanced mining royalties	18,678,087
Mining royalties	24,925,558
Deferred charges	1,618,063
Investments	3,548,202
Sinking-fund assets	60,483,524
Current assets	501,150,873
Total assets	$2,083,027,974

Of the annual assets, $181,901,005 represents materials and products on hand; $83,441,821, accounts receivable, and $148,394,761, cash on hand.

The income for the year, summarized and condensed as far as possible, was as follows:

INCOME FOR THE YEAR

Gross receipts	$1,231,473,779
Operating charges	867,762,218
Balance	$363,711,561
Royalties and rentals	4,730,147
	$368,441,708
Other income	6,434,459
	$374,876,167
Less adjustments and charges	31,879,075
Total earnings	$342,997,092
Interest and depreciation	48,970,528
Net income for year	$294,026,564

Dividends paid were 7% on the preferred stock and 5% regular and 3¾% extra on the common stock. The totals were $25,219,677 on preferred and $44,476,469 on the common. From the net income for the year, deductions of $22,619,804 for interest and premiums and the dividends noted leave a surplus of $201,835,585 for 1916.

Total shipments to domestic customers were: Rolled steel and other finished products, 13,075,295 tons; pig iron, ingots, spiegel, ferro and scrap, 524,885 tons; iron ore, coal and coke, 1,172,958 tons; and sundry materials and byproducts 160,483 tons. Total tons all kinds of materials, except cement, 14,933,621; universal portland cement (bbl.) 10,861,426.

The export shipments were: Rolled steel and other finished products, 2,466,793 tons; pig iron, ingots and scrap, 32,636 tons; sundry materials and byproducts, 2198 tons; total tons all kinds of materials, 2,501,627.

The active demand for iron and steel products for both the domestic and export trade, which prevailed at the opening of the year 1916, referred to in last year's annual report, continued during the entire year. These demands exceeded the capacities of the mills, and consequently prices advanced throughout the year. The tonnage of unfilled orders of the subsidiary companies at Dec. 31, 1916, was 11,547,286 tons of rolled steel products, the highest total ever recorded in the history of the Corporation, and exceeding by 3,741,066 tons, or 47.9%, the unfilled tonnage at close of 1915. The character of the order book is excellent. The bulk of the tonnage covers the needs of buyers for definite contract work or their requirements for operation and maintenance, thus encouraging the belief that the operation of the mills at their full capacity will be continued for at least the greater part of 1917. The export sales were for cash, and domestic sales were either for cash or on thirty- to sixty-day terms in accordance with the custom of the trade as to various commodities. Collections have been unusually good.

During the entire year 1916 the several producing properties and plants of the subsidiary companies were operated at substantially their maximum capacity, except as they were at times prevented by reason of the unusual conditions prevailing as to labor supply and railroad transportation. The production during the year of basic raw and semifinished materials and of rolled and other finished products for sale to customers, exceeded, except in respect of cement, the output in any previous year.

TOTAL PRODUCTION IN 1915 AND 1916

Products	1916	1915
Iron Ore Mined		
In the Lake Superior Region	Tons	Tons
Mesabi Range	24,928,039	17,209,664
Vermilion Range	1,314,002	1,273,825
Gogebic Range	2,369,460	1,277,419
Menominee Range	996,983	939,304
Marquette Range	647,132	618,108
In the Southern Region		
Tennessee Coal, Iron & R. R. Co.'s Mines	3,099,553	2,351,356
Total	33,355,169	23,669,676
Limestone Quarried	7,023,474	5,795,925
Coal Mined		
For use in the manufacture of coke	26,606,041	20,800,204
For steam, gas and all other purposes	6,162,340	5,828,278
Total	32,768,381	26,628,482
Coke Manufactured		
In bee-hive ovens	12,479,160	9,701,692
In byproduct ovens	6,422,802	4,799,126
Total	18,901,962	14,500,818
Blast-Furnace Production		
Pig iron	17,412,049	13,517,598
Spiegel	31,486	7,175
Ferro-manganese and silicon	164,102	116,735
Total	17,607,637	13,641,508
Steel-Ingot Production		
Bessemer ingots	7,273,766	5,584,198
Open-hearth ingots	13,636,823	10,792,294
Total	20,910,589	16,376,492
Rolled and Other Finished Steel Products for Sale		
Steel rails (heavy and light tee and girder)	1,533,681	1,129,832
Blooms, billets, slabs, sheet and tinplate bars	1,881,526	1,404,443
Plates	1,332,262	974,741
Heavy structural shapes	1,029,682	726,082
Merchant steel, bars, hoops, bands, skelp, etc	2,715,277	2,118,366
Tubing and pipe	1,338,892	919,280
Wire rods	278,197	261,036
Wire and products of wire	2,004,494	1,771,945
Sheets (black and galvanized) and tinplates	1,786,642	1,368,178
Finished structural work	557,953	476,896
Angle splice bars and all other rail joints	277,271	190,758
Spikes, bolts, nuts and rivets	95,096	74,289
Axles	173,530	95,476
Steel car wheels	107,167	77,569
Sundry steel and iron products	349,122	173,748
Total	15,460,792	11,762,639
Spelter	55,898	32,031
Sulphate of iron	46,263	35,377
	Bbls.	Bbls.
Universal Portland cement	10,425,600	7,648,658

The expenditures during the year on capital account for additions to the properties and new construction and for stripping and development work at mines, equaled the

net sum of $59,563,983. The expenditures made for these purposes since the organization of the Corporation aggregate $553,377,684. For 1916 they were a total of $59,563,983.

The volume of business done by all companies during the year, as represented by their combined gross sales and earnings, equaled the sum of $1,231,473,779, as compared with a total of $726,683,589 in the preceding year. This amount represents the aggregate gross value of the commercial transactions conducted by the several subsidiary companies, and includes sales made between the subsidiary companies and the gross receipts of the transportation companies for services rendered both to subsidiary companies and to the public. The earnings for the year resulting from the gross business represent the combined profits accruing to the several corporate interests on the respective sales and services rendered, each of which is in itself a complete commercial transaction.

The Duluth (Minn.), plant of the Minnesota Steel Co. was completed during the early part of the year in accordance with original plans, and all departments were placed in operation. The output of the plant in 1916 was 242,972 tons of rolled-steel products of various classes, or about two-thirds the rated full annual capacity of the plant. The new cement plant, constructed by the Universal Portland Cement Co., and adjoining the Minnesota steel plant, was also put into operation during the year, producing 710,600 bbl. of cement in 1916.

Other Important Additions and Betterments

Other important additions and betterments for which large outlays were made by the subsidiary companies during the year are the following: On account of the construction of new byproduct coke plants at Clairton and New Castle, Penn., and at Youngstown, Cleveland and Lorain, Ohio, expenditures of $3,695,554 were made during the year. These five plants when completed will have an aggregate of 1488 ovens. In the Pittsburgh district, at Edgar Thomson works, there has been installed a central pumping station and water-distributing system; at openhearth plant No. 3 of Homestead works, a 1500-ton hot-metal mixer; at Schoen steel wheel works, an additional unit increasing the capacity by 150,000 wheels per annum; at Clairton works, the installation of two additional openhearth furnaces and a 1200-ton hot-metal mixer; at Donora works, the construction of a duplexing steel plant, including two 25-ton bessemer converters and a 300-ton hot-metal mixer. Additional expenditures were also made at the Donora zinc-smeltery for the installation of muriatic-acid and zinc-oxide departments, and the finishing up of the final construction of the spelter plant. The output of the Donora plant in 1916 was 22,800 tons of spelter, 108,277 tons of sulphuric acid and 5624 tons of muriatic acid.

In the Valley districts, at Youngstown, Ohio, there were completed three additional openhearth furnaces, and substantial progress was made in the construction of the new McDonald merchant-bar plant, which is to comprise 10 mills of various types and sizes; at Farrell, Penn., three additional openhearth furnaces were installed. At Ellwood City, Penn., work was actively prosecuted in the enlargement and extension of the seamless tube plant of Shelby Steel Tube Co.

In the Cleveland district, at the Cuyahoga works of American Steel and Wire Co., there was completed a new rod mill and there were installed additional wire-drawing buildings with equipment; and work is progressing on the construction of a new rolling mill for hot- and cold-rolled flats. At Lorain, Ohio, works of The National Tube Co., four new openhearth furnaces were completed, and work is in progress on the construction of two additional furnaces and a new 40-in. blooming mill.

In the Chicago district, the Indiana Steel Co. at Gary, made substantial progress in the construction of four new blast furnaces, a duplexing steel plant, including two 25-ton bessemer converters and two tilting open-hearth furnaces; a 40-in. blooming mill, 160-in. sheared plate mill, three merchant mills and new forged-steel wheel plant; and the American Sheet and Tin Plate Co. practically completed the construction of a new tin-plate plant of 24 hot mills. At the South Chicago plant of Illinois Steel Co., progress was made in the installation of a duplexing steel plant of two 25-ton bessemer converters and two 100-ton tilting openhearth furnaces; also in the construction of an electric steel plant of two 20-ton furnaces, one tilting openhearth furnace, forging presses, etc. The ore-storage yards at this plant were extended and equipment improved during the year. At Joliet works of Illinois Steel Co. a new benzol-recovery department was installed at the byproduct coke plant.

Additional Transportation Equipment

During the year the subsidiary railroad companies purchased or constructed additional equipment consisting of 84 locomotives, 3471 freight cars and 34 road cars of various kinds, the aggregate cost of which was $6,908,177. There were purchased and placed in commission during the year on the Great Lakes two 12,700-ton capacity and six 6500-ton ore-carrying vessels; also one supply boat. The total cost of these vessels, together with payments made in 1916 on account of cost of four additional 12,700-ton steamers deliverable in 1917, was $3,517,496. There was completed by the Duluth & Iron Range Railroad Co. a new steel ore-dock at Two Harbors, Minn.

At the close of 1916 the amount unexpended on authorized appropriations for extensions, additions and betterments, including iron-ore mine-stripping operations for 1917, was approximately $137,000,000. It is estimated that about $100,000,000 of this total will be expended in 1917. These authorizations cover the outlays yet to be made to complete the important improvements herein described as in course of construction at the close of the year, also several important new extensions and additions, as well as a wide range of miscellaneous work.

The principal new extensions and additions authorized and not heretofore mentioned are the following: The contemplated construction at Gary, Ind., of a tube plant, the plans for which have not yet been fully developed, will comprise blast furnaces and steel works as well as finishing mills. At the Edgar Thomson works of Carnegie Steel Co. extensive improvements are to be made to the blast-furnace plant; at Duquesne works of a new 12-in. bar mill will be installed; at Farrell works the billet and bar mills are to be reconstructed; extensions are to be made to the tin-plate plants at Shenango and Farrell works. A complete complement of equipment is to be put in service for use in hauling coal on river from mines to the new byproduct coke plant at Clairton, and a pipe line is to be installed for conveying gas from this plant to steel plants in the Pittsburgh district. The

Duluth, Missabe & Northern Railway Co. is constructing at Duluth, Minn., a new steel ore-dock of 384 pockets. There have been ordered by the subsidiary railway companies, for delivery to them in 1917, equipment aggregating 31 locomotives and 3195 steel cars.

In January, 1917, there was offered to the employees of the United States Steel Corporation and of the subsidiary companies the privilege of subscribing for common stock of the Corporation, at the price of $107 per share. Subscriptions were received from 39,072 employees for an aggregate of 67,410 shares. The conditions attached to the offer and subscription, aside from the feature of price, were generally similar to those under which stock has been heretofore offered to employees. The usual distribution of special compensation to employees under the plan adopted in 1903 was also made.

The trustees of the United States Steel and Carnegie Pension Fund disbursed during the year 1916, in pensions to retired employees, the sum of $711,130.33. Pensions were granted during 1916 to 276 retiring employees. At the close of the year there were 3013 names on the pension rolls. The average age at which pensions have been granted to retiring employees since the inauguration of the plan is 65.33 years, and the average term of service rendered by such pensioners was 29.93 years.

The total amount expended by the Corporation and the subsidiary companies during the year for safety work was $848,080, in comparison with $608,644 expended in the previous year. The number of fatal accidents in 1916, based on the number of accidents per 100 employees, was 44.46% less than in 1906; and the number of fatal and serious accidents combined was 31.60% less than in 1906. The efforts of the companies to safeguard employees from injuries, through installation of safety devices, facilities, etc., are assisted by the employees themselves through duly appointed committees. At present 4773 employees are serving on safety committees

Total Amount Disbursed for Accidents

The total amount disbursed by all the companies during 1916 in connection with work accidents was $2,593,960. Of the amount disbursed during the past year, 88% was paid directly to the injured employees or their families or in taking care of them. These payments were made either in accordance with the provisions of the workmen's compensation laws enacted by the several states in which the subsidiary companies are operating, or under the Corporation's Voluntary Accident Relief Plan, which was introduced by the Corporation prior to the enactment of the laws referred to. These compensation laws, which have been promptly accepted by the subsidiary companies, merely established the principles upon which the voluntary relief plan, regardless of legal liability, had been previously inaugurated by the Corporation.

The amount expended during the year for sanitary work in and about the mines and mills was $1,402,798, in comparison with an expenditure of $953,056 in the previous year. The sum of $322,595 was expended for protection of water supply and drinking water systems for the use of employees. During the year there were installed an additional 313 showers and 10,662 lockers.

The efforts of the Corporation and the subsidiary companies toward the improvement of the material welfare of employees and their families, referred to in the previous year's annual report, have been continued. During the last summer the area of gardens maintained by employees on the companies' lands covered nearly 1000 acres. At present there are maintained 17 clubs for employees with a membership of 5242; also 137 playgrounds, 125 athletic parks and 8 swimming pools, all of which have either been constructed by the subsidiary companies or in the construction of which they have materially assisted.

EMPLOYES AND PAYROLLS

Employes of	1916, Number	1915, Number
Manufacturing properties	187,289	140,875
Coal and coke properties	25,143	19,485
Iron ore properties	12,624	9,668
Transportation properties	24,189	18,240
Miscellaneous properties	3,423	2,858
Total	252,668	191,126
Total salaries and wages paid	$263,385,502	$176,800,864
Average Salary or Wage per Employee per Day:		
All employees, exclusive of General Administrative and Selling force	$3.29	$2.9[illegible]
Total employees, including General Administrative and Selling force	$3.36	$3.01

A. I. M. E. for Universal Military Training

The American Institute of Mining Engineers, at a meeting held in New York, Mar. 23, adopted resolutions favoring universal military service and urging the immediate complete preparedness of the army, navy and industries for war purposes as follows:

Whereas, The integrity and life of this nation is dependent upon its ability to successfully defend itself against foreign aggression and attack; and

Whereas, It is necessary that the nation be properly prepared to the end that our untrained patriotic volunteers be not uselessly slaughtered and our country disgraced and defeated; be it therefore

Resolved, That the Board of Directors of the American Institute of Mining Engineers believe that compulsory universal military training should be at once instituted and that adequate, complete and immediate preparedness should be provided.

Be It Further Resolved, That we believe that thorough and complete preparedness in the army, the navy, and the industries of the country is vital; anything less is unsatisfactory and insufficient, and may result in disaster to the nation.

Be It Further Resolved, That a copy of this resolution be transmitted to the President of the United States and to each Senator and Congressman.

Dry Concentration of Gold Ore

Referring to my article on "Dry Concentration of Gold Ore," in the *Journal* of Feb. 17, 1917, Bala Lake, where I went to examine this small plant, is in North Wales, not in West Australia. The mine in North Wales was first opened in 1863. Gold was first worked on a large scale in West Australia about 1892.

On page 305, seven lines from the bottom of the second column, perforations should be $\frac{1}{10}$ in. instead of $\frac{1}{16}$ in. On page 306, third line from top of second column, I should like to add the fact that the concentrates contained 50 to 60 oz. bullion. The classifier beats, in the table at the foot of the column, should be 900 to 1000 per minute, not revolutions per minute.

Leonard Goodday.

309 Gladstone Ave., Ottawa, Mar. 5, 1917.

Editorials

The Copper Producers to the Government

Nothing has excited more comment lately in the copper market than the agreement by the producers to furnish about 45,000,000 lb of copper to the United States Government for military purposes at 16⅜c. per lb., the delivery to be spread over a year from Apr. 1, 1917. This has drawn out remarks of the following nature:

From the pessimist: The producers have but little confidence in the future of copper.

From the stockjobber: There are not going to be any large war profits if the producers are going to sell their stuff so cheaply.

From the manufacturer: If the copper producers can supply the Government at so low a price, why not us?

The simple fact of the matter is that the copper producers desired to show their patriotism in a concrete, unequivocal way. Many other persons have said that they would put their plants, products, etc., at the disposal of the Government, but no one of whom we know, except Mr. Ford, has named terms. The copper producers, believing that actions speak louder than words, acted. In all probability they will be able to sell their entire output up to Apr. 1, 1918, at a much higher price than what they have made to the Government. Their sole idea was to be generous to the Government, to be patriotic.

Looking at the transaction from the economic standpoint, the total quantity that is involved is relatively small, being only about a week's output at the present rate. The delivery of one-fourth of this copper during the second quarter of 1917 will cause some inconvenience; after that none at all, for but little of the production expected after July 1 has yet been sold. The quantity of copper thus contracted for the Army and Navy is so small that it looks as if the military program were not to be very extensive. However, in this connection it is to be remarked that the immense quantities of copper that have been purchased by the Allies have not been solely for military purposes, but have been for all the uses of the nations, industrial as well as military. Just what the military requirements have been is known to no one outside the munitions ministries.

But if America goes into the war with the Allies, why should not we help them also with cheap copper, cheap steel, etc.? In the first place, the Allies have not heretofore been obliged to pay extravagant prices for copper. Their first big purchase was at 20c. The 448,000,000-lb. transaction was at 25c. A subsequent transaction—about 40,000,000 lb.—was at 27c. The Allies have had their copper as cheaply as the American consumer.

It is conceivable that if the United States should undertake to finance the Allies, some arrangement would be made for special terms for supplies for governmental purposes, but the market for general consumption must necessarily be left to itself and must be determined by natural laws. Anything else would be dangerous. It does not follow from this that the price of copper is going to be 30c. or more; nor is there any reason why it should be except for bad buying, which the governments can, and probably will, avoid. The copper producers in 1916 averaged about 24 to 25c. on their deliveries. For their deliveries in the first half of 1917 they will average around 27c. Those are not extravagant prices. Such levels were attained in 1906-7, when there was no war, nothing but an unusual industrial demand. That copper producers make a great profit at 25c. there is no doubt, but it is necessary to permit producers to realize a great profit in order to insure a large and rapidly increasing production, which is the most essential thing. When the production has become large enough, the price will automatically decline. The copper market will be better for everybody if a decline to 20-25c. comes soon.

The International Nickel Co.

The International Nickel Co. was unable to resist the importunities of its stockholders, who regarded as quixotic and unfair the policy of keeping the price for nickel at ante-bellum figures, and it recently announced an increase of 5c. per lb. This will not affect the long-running contracts until they expire and probably will not affect the contract with the British government at all.

The International Nickel Co. has been in a difficult position ever since the war broke out. Getting its raw material from mines in Canada and being obliged to bring it to New York for refining, it became immediately the target for attack by politicians in Canada, who charged that Canadian nickel was being allowed to go to Germany for the purpose of killing Canadian soldiers, while the more moderate charge was that the British government was the victim of a foreign monopoly of its own colonial resources.

The company met these charges by showing that it had put its business under the supervision of the Canadian authorities, so that they might assure themselves of no improper consignment of the product. And it was shown, moreover, on the floor of the Dominion Parliament that the British government was being supplied with nickel at the same price as before the war. For that matter it has been of public notoriety that the price for nickel to everybody was practically unchanged.

That very thing excited clamor among the stockholders. With the prices for copper, steel, zinc, lead and nearly everything else at fabulous figures, why should there not be some advance in nickel? To this the management finally had to bow, but what it did was very moderate.

Throughout these delicate situations the International Nickel Co. has conducted itself with great moderation and propriety. Besides doing the things that have herein before been mentioned, it has deferred to the popular demand in Canada that some of the Canadian nickel should be refined at home, and is now building a large refinery in Canada, although without any doubt the work will be

done there less economically than in New York. Along with this it has a prospective competitor in the company Messrs. Carlyle and Mathewson are directing technically

The Gift of the Copper Producers

The statement that has been made that the copper selling agencies with German affiliations did not participate in the sale of copper to the United States Government at 16⅔c. is correct. The further statement, going the rounds, that it was peculiar, or not peculiar, that they failed to do so, involves entirely erroneous implications. None of the copper selling agencies participated in the transaction. They do not produce any copper. They sell it simply as commission merchants or traders. If in the former position they would have to refer to their principals; if in the latter, they would have to sell for 16⅔c. what they would have to buy at 30c. or more, in order to make the delivery, which would be something not reasonably to be expected. The only corporations or persons who could supply this copper at a very low price were those who commanded an original source of it. Participation in the transaction was, therefore, an affair of producers, not of custom smelters, refiners, or selling agencies.

Another fallacy that has been going around the streets is that even at 16⅔c. the producers are making a fat profit, the cost of production being only 8c. per lb., or so. The average cost of producing copper used to be a subject of voluminous discussion before the war. While no absolute conclusion could be reached, the consensus of opinion was that the average cost to the big producers was about 10c. per lb., this representing the direct charges on production, and being exclusive of charges on capital account. There were some big producers showing lower figures, to be sure, but in many cases their real figures were not so low as they were made to look for stock market purposes. As a matter of fact, 10c. per lb. has been below what experience has demonstrated as being the bed-rock price during the last 10 years. In 1907 and in 1914 the cataclysmic declines halted at about 12c. Since 1914 the cost of production has increased, as everybody knows.

Kennecott Increases Its Interest in Utah

The announcement of the purchase by the Kennecott Copper Corp. of 200,000 shares of the Utah Copper Co. explains the great strength in Utah during the last six months when the acquisition was going on. Judging from the announcement as to the financing of the operation, the cost of the new block of stock was about $100 per share.

Kennecott previously owned a little more than 400,000 shares of Utah, which it acquired from the Guggenheim Exploration Co. With the new block of shares it owns about three-eighths of the total issue of Utah, and with the private holdings of the Guggenheims and persons closely associated with them, the Morgan-Guggenheim group is now probably in majority interest in Utah, which in turn controls Nevada Consolidated.

There has been a good deal of talk of consolidation of Utah with Kennecott, but it is now denied that anything of that sort is contemplated. Rumor goes on further to say that such a consolidation was being considered, but was opposed by an important independent interest in Utah, which was strong enough to block the project and intended to do so, in the courts, if necessary. The present outlook is, therefore, that Utah will bear the same relation to Kennecott that Nevada Consolidated does to Utah.

The explanation of Kennecott's purchase is now that its management regards Utah as the best investment for its great surplus. Railway companies buy the stocks of one another, so why should not mining companies, conforming to the sound policy of sticking to the business in which the management is most experienced? Anyway, Kennecott's great interest in Utah will give it increased stability and will help to tide it over any adversities in Alaska that may transpire.

Cherryvale Makes an Endurance Record in Zinc Smelting

On Mar. 12, 1917, block "C," comprising 600 retorts at the Cherryvale works of the Edgar Zinc Co., completed a campaign of 10 years. This furnace, which is natural-gas-fired, was put on full charge Mar. 12, 1907, and has been running steadily ever since; that is the fire has never been out. During the 10 years smelting was interrupted for 15 days owing to labor troubles and for 15 days owing to breakage of gas mains, but during those times the furnace was on dead-fire, which means that the temperature is maintained at red heat, and everything is in order for raising the temperature and proceeding with smelting. During the period of 10 years this furnace produced 29,136 tons of spelter.

A campaign of a zinc-distilling furnace is ordinarily somewhere around three years, in good practice. Campaigns of five years or so are on record, and are regarded as extraordinary. The 10-year campaign of "C" furnace at Cherryvale is phenomenal and surpasses anything else whereof we know. Such a thing is possible only with furnaces of the good construction which characterizes those at Cherryvale, and with good care. Certainly, great credit is reflected upon O. F. Garrison, the manager. We need not discuss the differences due to natural-gas firing vs. coal-gas firing, to temperature of smelting, etc. Admitting that all conditions may have been in favor of the Cherryvale furnace, a 10-year campaign is something remarkable anyhow. We say "a 10-year campaign," but it will be even longer, for the furnace is still in operation; Mar. 12, 1917, was simply a decennial celebration.

The Judge Mining and Smelting Co., of Park City, Utah, put its electrolytic zinc plant in operation on Feb. 25, producing about three tons of zinc per 24 hours, which is gradually to be increased to 12-15 tons. This plant, which was designed and built by C. A. Hansen, is especially interesting from the fact that it is the first zinc plant to be equipped with rotating, circular cathodes. That is to say, it is the first modern plant using zinc-sulphate electrolyte. Doctor Hoepfner employed such cathodes in the old plants at Führfort in Germany and at Winnington in England, but at those plants the electrolyte was zinc chloride. At Anaconda, Great Falls and Trail the electrolytic vats have stationary cathodes, similar to those of the electrolytic copper refinery. Rotating cathodes offer some distinct theoretical advantages, against which there are some disadvantages (among which are considerably higher first cost), but they have not yet had a trial in modern practice. The Park City plant will provide that. It is to be hoped that it will be successful.

BY THE WAY

The John Fritz Medal Board of Award has published a book giving a history of the medal, the rules of its award, biographical notices of the medalists illustrated with portraits, etc. The book is for sale and may be obtained from the secretary, John Fritz Medal Board of Award, Engineering Societies Building, New York City.

Charles A. Sulzer, Democrat, and brother of former Governor William Sulzer, of New York, was elected Delegate to Congress from Alaska last November by a majority of 19 votes, according to a decision of United States Judge Robert W. Jennings sitting at Juneau, Mar. 21. The canvassing board had declared James Wickersham, Independent Republican, elected, but an appeal was taken to the Federal Court. Wickersham has served four terms as Delegate from Alaska.

Announcement is made that applications for the Emmons Memorial Fellowship in Economic Geology will be considered, and an incumbent appointed prior to the first of June. Applications should be sent to Prof. J. F. Kemp, of Columbia University, not later than May 15. The holder of this fellowship will receive an income of $1000 and is expected to carry on an investigation in economic geology that will add a distinct contribution to the literature. The institution at which the study is pursued will be decided after conference with the members of the Committee of Awards. The character of the investigation will be decided after applications have been passed upon.

The late August Raht deserved the name of the "Prince of Fishermen" as much as that of the "Prince of Lead Smelters," by which he used to be known in the metallurgical profession. Years ago, staying one summer on one of the Canadian lakes, famous as the habitat of those two most beautiful species of lake trout, locally called "Copperlonge" and "Silverlonge," the former of the color of burnished copper, the latter of polished silver, he was for some time unsuccessful in catching a single specimen. Concluding that the water near the surface was too warm to suit those "longes," he rigged a contrivance for deep-water trolling, and soon was rewarded by ample catches. It was this kind of intuitive knowledge and resourcefulness that helped him in his profession over the perplexities occurring in the treatment of ores.

Bankers greeted with remarkable enthusiasm, said the *Evening Post,* the suggestion of W. P. G. Harding, governor of the Federal Reserve Board, that this country should not hesitate to extend a credit of $1,000,000,000, taking as security the simple obligation of Great Britain and France. Some even believed that this did not go far enough; and one asserted that we have already lent Europe about $2,000,000,000. We can continue to lend money; but what we need to do if we enter the war is to "buy some of the Allies' chips." "There is no use," said one banker, "of a three-foot man trying to do a six-foot man's job. We are military infants. We can't send our poor little group of soldiers over to Europe. It would take too much time to equip and train them. Something might happen to them. They might be mistaken for a Cooks' tour. And, besides, if we are to assume that the end of the war is near, it would be folly to direct munitions and money from Europe for equipping a large army of our own, when it would not be ready till the war's end. But we are giants in finance. We are *the* giant. I doubt whether people realize how wonderfully well this war has prepared us, from a financial standpoint. Financing the war should be our task. Lending money to the Allies would make us most immediately and fearfully effective."

There is a market-letter writer in Wall Street who frankly admits that he judges the course of the market not by reason, but by intuition. "When I write my market advice in the morning," he says, "I simply try to get the 'feel' of the market. I say that the outlook is that the market will go up, or that the outlook is that it will go down. Sometimes I give my reasons, but very often I don't. I simply cannot give my reasons because I do not know them. Frankly, I write on what I suppose you would call a hunch." People may call this superstition, but people do not know. This market-letter writer often does give the reasons for his predictions; he is a keen student of conditions and of the technical status; and while he is sometimes wrong on the market, his record compared with that of other market-letter writers is astonishingly good, says the writer of Wall Street Paragraphs in the *Evening Post,* who proceeds to remark: "A phenomenon not unlike this is often observed among fishermen, farmers, guides and others who qualify as local weather prophets. Though they occasionally talk of winds and moisture and the look of the sky, they have little scientific knowledge of weather; yet they have an uncanny habit of being right. The psychologist, William James, somewhere gives an example of dentists who can tell you that a tooth will break, but cannot tell you why it will break. And what is the explanation in each instance—market prophet, weather prophet and dentist? The explanation is that in each instance the individual has acquired over years of experience a mass of empirical knowledge which far outruns his scientific knowledge. He has unconsciously or half-consciously absorbed an indefinite number of items of knowledge which he has not analyzed. In his judgment of things, these items of knowledge lying at the back of his mind act as reasons, but they are too vague and incoherent to admit of explanation. 'Why don't you speculate?' the market-letter writer was asked. 'I used to,' he replied, 'but never successfully. When I speculate, my fears and hopes make me nervous and confused; I try to justify my moves with reasons pro and con, and I lose my hunch.'" Mining engineers will understand this. What engineer of long experience is there who cannot relate instances of being in an orebody penetrated by only one drift, with no means for measurement of ore in sight according to the accepted tenets, and feeling the conviction that he is in the midst of a whale of an orebody; and in another case that he is merely surrounded by a thin shell of ore? Yet in neither case can he outline any real reasons. If he tried to, they would very likely be weak. Of the same order is the advice, "Never give reasons. Your judgment may be fine and your reasons feeble." Who also does not remember cases of the mining engineer who is superb in his advice to clients and unsuccessful when he goes into mining ventures on his own account?

Personals

Charles E. Van Barneveld is in charge of the Tucson station of the U. S. Bureau of Mines.

A. J. Eveland has returned to New York after an absence of more than a year in South America. He is at the Engineers' Club.

J. W. Shields, mill superintendent of the Quincy, at Hancock, Mich., has resigned and the position has been filled by Ralph Hayden, formerly with the Anaconda.

Professor Jay Lonergan has resigned the chair of mining at the Peking Government University, China, and will return to America to resume active practice.

A. M. Bilsky has been appointed managing director of the Apex Mining Co. of Porcupine for the purpose of supervising the work of exploration by diamond drills.

W. A. Schmidt, who has been prominently associated with potash recovery in the West, is in Washington for a ten days' stay to confer with the Government's potash specialists.

E. D. Kilburn, manager of the Power Department of the New York office of the Westinghouse Electric and Manufacturing Co., has been appointed district manager of this office.

H. A. Morrison who has been superintendent at the Silver Dyke mine at Sodaville, Nev., is now engaged in unwatering and opening up the Oak Hill mine at La Grange, Calif.

Dorsey A. Lyon, metallurgist in charge of the Seattle station of the Bureau of Mines, will visit Washington in the near future to discuss with Bureau officials some phases of the work in the Northwest.

S. M. Soupcoff has joined the staff of the mining department of the American Smelting and Refining Co., and will have charge of the field work of the Salt Lake office with headquarters in the McIntyre Building.

W. S. Rugg, formerly district manager of the New York office of the Westinghouse Electric and Manufacturing Co., succeeds Chas. S. Cook as manager of the Railway Department with headquarters at East Pittsburgh.

S. A. Hollman, for three years superintendent, has been appointed general manager for the Balaklala mine, at Coram, Calif. George S. Ferguson, assistant manager under Frank Leland, has resigned and retired to his ranch.

E. P. Dillon, formerly assistant to manager of the Railway and Lighting Department of the Westinghouse Electric and Manufacturing Co., at East Pittsburgh, has been appointed manager of the Power Division of the New York office.

George S. Rice, chief mining engineer of the Bureau of Mines, attended the conference held in Albany, N. Y., by the New York Industrial Commission, which is considering a revision of the state's mining laws. Mr. Rice represented the U. S. Bureau of Mines at the meeting.

Simon Guggenheim was trapped in a snowslide, on Mar. 17, at the summit of Mt. Cœur d'Alene, Idaho, his train being blocked by snowslides ahead and behind it. A relief train was able to reach Dorsey, within a mile of the blockade, and passengers were compelled to go down the mountain to it.

J. F. Hanst, formerly senior engineer on the staff of the Cleveland-Cliffs Iron Co., Ishpeming, Mich., and in charge of engineering operations at its new Athens mine, has resigned his position with that company to accept one with the Andes Copper Mining Co., at Potrerillos, Chile, S. A., and will sail from New York with his family on Apr. 7.

Howard F. Weiss, director of the Forest Products Laboratory, at Madison, Wis., has tendered his resignation to become effective Apr. 1. He has accepted a position with the C. F. Burgess Laboratories (Chemical Engineers), at Madison, Wis., and will engage in the development of products and processes involving a more profitable utilization of wood and timber.

Dr. James Douglas, of New York, has given Queen's University of Kingston, Ont., another donation of $63,000 to meet deficits in various departments. The will of the late Dr. George C. Hoffman of Ottawa, former assistant director of the Canadian Geological Survey contains a bequest of $35,000 to Queen's for the establishment of fellowships in surgery and pathology.

J. Morgan Clements, of New York, has been selected by the Bureau of Foreign and Domestic Commerce, of the Department of Commerce, Washington, to make a survey of the mineral resources of the Far East, including China and Siberia. Before leaving, this spring, he will visit American concerns that are interested in the development of mineral resources across the Pacific to get a definite idea of the specific points that require elaboration.

Archer E. Wheeler, formerly superintendent of the Great Falls smeltery, now consulting engineer for the Union Minière du Haut Katanga, in the Belgian Congo, Africa, has secured the services of H. Y. Eagle, S. Ward Haas and P. E. Weldy, employees of the Anaconda Copper Mining Co., to design and erect a leaching plant and electrolytic copper refinery at the property of the Belgian company. The men have left for New York, where the plans will be completed before going to London, whence they will continue to the Congo.

Col. J. C. Maben, long president of the Sloss-Sheffield Steel and Iron Co., Birmingham, Ala., has resigned and has been made chairman of the board. He will be succeeded temporarily by James N. Wallace, president, Central Trust Co., New York, but it is expected that later a man actively engaged in the manufacture of iron will be elected. Colonel Maben will reside in New York at the Waldorf-Astoria.

Prof. W. D. Bancroft, Cornell University, has been selected by the board of directors of the American Electrochemical Society to represent electrochemistry on the Chemistry Committee of the National Research Council.

Dr. W. A. Lynott has resigned his position with the U. S. Bureau of Mines to be the official physician for the Southwest Missouri Mine Safety and Sanitation Association. He will have his headquarters at Webb City, where he will look after the free clinic and dispensary that was established there by the association about two years ago, and will spend a portion of the time in the field, teaching miners first aid and sanitation. He will enter his new work with a contract for three years' employment and will begin his duties Apr. 1. Approximately $10,000 was raised by private subscription, in cash, as a guarantee of Dr. Lynott's salary.

Obituary

A. Y. Cannan, discoverer of the A. Y. and Minnie mine, in Colorado, is dead, according to a Denver report. He was 84 years old.

Ferdinand W. Roebling, secretary and treasurer of John A. Roebling's Sons Co., Trenton, N. J., manufacturers of wire rope, died on Friday, Mar. 16, 1917.

Alexander Sutherland, a workman employed at the sandpits of the leaching plant at the Washoe works in Anaconda, Mont., was killed Mar. 15 by being smothered under caving sand.

David Rainey, 62 years old, of Birmingham, was killed on Mar. 10, 1917, when he fell from a cliff at Stewart, British Columbia, where he was owner of several gold and copper mines. He leaves a widow and two sons, a mother 80 years old, a sister and two brothers.

Frank Mingus, a miner was killed March 15 in the Anaconda company's Mountain Con mine, at Butte, when a heavy bucket falling through the shaft struck him while he was working in the sump and practically decapitated him. The bucket was suspended from an auxiliary cage operated by a hoisting engine on the 2300-ft. level, became unfastened while being lowered.

Edward Payson Ferry, pioneer mining man of Utah and once a legislator, died Sunday night, Mar. 11, 1917 in Los Angeles. Mayor W. Mont Ferry, of Salt Lake City, is his only living son. Mr. Ferry was born April 16, 1837. He will be buried from the church that his father built.

Mr. Ferry went to Utah in 1878. Going to Park City as the representative of Eastern capitalists, he took charge of the development of properties that were later parts of the Silver King Coalition and Daly-Judge mines. He became identified politically with the Liberal party and was one of its leaders, being elected for two terms to the territorial legislature from Summit County. He was president of the Trans-Mississippi congress in Denver in 1891. In addition to his son, Mayor Ferry, Mr. Ferry is survived by two daughters, Mrs. Charles C. Reynolds of Los Angeles and Mrs. Dana T. Merrill of Washington.

Societies

Canadian Mining Institute held a well-attended meeting of the Western Branch in Vancouver, Mar. 15 to 16, with Robert R. Hedley presiding. The papers presented were as follows: "Notes on an Iron and Steel Industry for British Columbia," by R. R. Hedley, Vancouver; "Manufacture of Pig Iron," by M. W. Garman, Nanaimo, Vancouver Island, B. C.; "Five Years of Progress in Metallurgy," by Francis A. Thomson, Pullman, Washington, head of the Department of Mining Engineering at the State College of Washington; "Lode-Mining Industry of Vancouver Island," by W. M. Brewer, Victoria; "Notes on the Copper Deposits of the Northern Interior of British Columbia," by John D. Galloway, assistant mineralogist for British Columbia; "Necessity for Technical Instruction in the High Schools in Mining Districts of the Province," by John Kyle, organizer of technical education in British Columbia, and a description of the Tacoma Smelting Co.'s smeltery and refinery at Tacoma, Wash., by Dale W. Pitt, one of the company's field engineers. The Applied Science Department of the University of British Columbia was represented by J. M. Turnbull, acting dean; J. G. Davidson, professor of physics, and E. T. Hodge, professor of geology and mining. Dr. Davidson spoke on the Cottrell dust and fume precipitation process, giving information relative to its great success in connection with recovery of copper, lead and zinc from ores of those metals, and of its later successful adoption in treating mercury ore. Dr. Hodge, in discussing the question of the establishment of an iron and steel manufacturing industry in the Province, urged the necessity of obtaining much more specific information concerning the extent and nature of the available iron-ore deposits before advocating large expenditures in iron-smelting and steel-manufacturing plants. The discussion of the papers relating to iron and steel was animated and prolonged, Mr. Kyle, who showed many stereopticon views of technical schools and classes of students at work, strongly urged the active support of mining men generally in securing more technical instruction in the public high schools of British Columbia. Views of the Granby Consolidated Co.'s Hidden Creek mine and copper smelting works at Anyox, in the Coast district of British Columbia, and of the Britiannia copper mine and modern concentrating mill, near Vancouver, B. C., were shown by E. Jacobs, branch secretary, who briefly commented on those important industries. A demonstration of the new Type "B" Pulmotor attracted general attention.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Crushing Roll. Laurent G. G. Dibbets, The Hague, Netherlands. (U. S. No. 1,219,927; Mar. 20, 1917.)

Tunneling or Excavating Machine. Oliver O. App, New York. (U. S. No. 1,219,419; Mar. 20, 1917.)

Mine Car Dumping Apparatus. William A. Williams, Barton, Ohio. (U. S. No. 1,218,029. Mar. 6, 1917.)

Cars—Safety Stop for Mine Cars. Joseph Klansnic, Black Diamond, Wash. (U. S. No. 1,219,748; Mar. 20, 1917.)

Mine Door Operating Apparatus. William Martin Hummel, Lewistown, Penn. (U. S. No. 1,218,404; Mar. 6, 1917.)

Ore Separator. William P. Clifford, Ottumwa, and John C. Cook, Russell, Iowa. (U. S. No. 1,218,170; Mar. 6, 1917.)

Pump—Deep Well Pump. Walter G. Black and August L. Segelhorst, Brea, Calif. (U. S. No. 1,219,799; Mar. 20, 1917.)

Amalgamation — Centrifugal Separator and Amalgamator. Harry R. Zimmer, Los Angeles, Calif. (U. S. No. 1,220,051; Mar. 20, 1917.)

Preheating—Process of Preheating Blast Furnace Gases. Otto Oesterlen, Zweibrücken, Germany. (U. S. No. 1,219,852; Mar. 20, 1917.)

Metal Refining—Apparatus for Refining Metals by Heating. Alois Helfenstein, Vienna, Austria-Hungary. (U. S. No. 1,220,111; Mar. 20, 1917.)

Sulphur—Method of Mining Sulphur and Other Minerals. Hampton P. Rhodes, Shreveport, La. (U. S. Nos. 1,217,065, 1,217,066; Feb. 20, 1917.)

Lead Metallurgy—Process for Separating Lead and Molybdenum from Mineral Wulfenite. Alan Kissock, Tucson, Ariz. (U. S. No. 1,218,412; Mar. 6, 1917.)

Drill Sharpener. Edward L. Oldham, Denver, Colo., asignor to The Denver Rock Drill Manufacturing Co., Denver, Colo. (U. S. Nos. 1,219,477; 1,219,478; Mar. 20, 1917.)

Lamp—Miner's Safety Electric Lamp. Richard Koch, Pittsburgh, Penn., assignor to The Concordia Safety Lamp Co., Inc., Pittsburgh, Penn. (U. S. No. 1,218,570; Mar. 6, 1917.)

Drills—Operating Mechanism for Rock Drills. William A .Smith, Denver, Colo., assignor to The Denver Rock Drill Manufacturing Co., Denver, Colo. (U. S. No. 1,219,498; Mar. 20, 1917.)

Tank Lining—Apparatus for Lining Reservoirs and the like. Gustav Monrath, Chuquicamata, Chile, assignor to Chile Exploration Co., New York. (U. S. No. 1,219,840; Mar. 20, 1917.)

Mining Machinery—Brake for Mining Machine Trucks. Edward L. Hopkins, Columbus, Ohio, assignor to the Jeffrey Manufacturing Co., Columbus, Ohio. (U. S. No. 1,218,402; Mar. 6, 1917.)

Agitator—Apparatus for Agitating Freezing Water. Edward H. Althoff, Salt Lake City, Utah, assignor of one-half to Louis A. Roser, Salt Lake City, Utah. (U. S. No. 1,219,897; Mar. 20, 1917.)

Elevator — Safety Device for Mine Elevator Cages. George Coates, Victor, Colo., assignor of one-eighth to Richard W. Coates and one-eighth to John S. Walker, Victor, Colo. (U. S. No. 1,219,918; Mar. 20, 1917.)

Blasting—Combined Powder Punch and Blasting Fuse Holder. Daniel James Watts, Iron River, Mich., assignor of one-fourth to Leonard J. Wright and one-fourth to Reinhold C. Doenitz, Iron River, Mich. (U. S. No. 1,219,609; Mar. 20, 1917.)

Editorial Correspondence

SAN FRANCISCO—Mar. 21

First Comstock Ore at 2700-ft. Depth has just been disclosed in the famous old Consolidated Virginia mine in this historic district in Storey County, Nevada. A dispatch from Whitman Symmes received at San Francisco today states that the ore runs $15 per ton. The strike is in absolutely virgin ground; the orebody, 9 ft. wide, has been penetrated for a distance of 45 ft. The reports for the week ended Mar. 17 showed a saving of 77 cars from 13 ft. along the vein, assaying $8 per ton. There was some improvement on Monday and on Tuesday and Wednesday the important strike was made. This is in the southwest drift from No. 2 west crosscut and is the first ore ever taken from a depth of 2700 ft. The old "bonanza crowd" never went below the 2500 level in extraction of ore. Present operators have been obliged to wait until the water was lowered, but began exploration as soon as they could get into the ground and are now rewarded for the undertaking and have proved their faith in the downward persistence of the orebodies.

Gold Dredging Lands of Natomas Co. of California still contain 250,000,000 cu.yd. of pay gravel, according to the annual report made public on Mar. 20. Prospecting, from which this estimate is made, was carried on throughout the year, and further prospecting will probably increase the estimated yardage in the Natoma division of the American River district and in the Feather River division of the Oroville district. The company owns and operates 11 dredges at Natoma and three at Oroville. During 1916 the gross recovery of gold by the 14 dredges totaled $2,137,120 and the net operating profit was $988,885. The dredges handled a total of 25,868,000 cu.yd. In this period No. 1 dredge was rebuilt and designed to resoil the land, and was out of commission nearly nine months. No. 7 was sunk on Apr. 1 and recommissioned Oct. 1, being closed down six months. The sum of $108,248 was expended in salving and rebuilding No. 7, which was charged to operating expense, reducing the net operating profits in that sum.

Mother Lode Carnival, in celebration of the Old Eureka reopening at Sutter Creek on Apr. 14, promises to be free from the disagreeable and disturbing element that frequently attends the street fairs in valley towns of California. Both the mining and agricultural interior communities are disposed to the enjoyment of out-door shows in the spring and summer seasons; often these celebrations or street fairs are gotten up by showmen from San Francisco or other cities; too frequently they are conducted in a disgraceful manner and attended by gamblers and skin-game operators of the lowest order. But the amusement committee of the Mother Lode Carnival and the Sutter Creek board of trustees have provided against the possibility of such disturbance by agreeing that no concessions will be given to other than legitimate and moral features of outdoor or indoor entertainment. There will be ball games, other athletic sports, music, dancing and such amusements as are clean and respectable and hence enjoyable to visitors from other portions of the county and state.

BUTTE—Mar. 22

First Commercial "Wireless" in Montana will "connect" the Montana Power Co.'s plants and offices at Butte, Great Falls, Thompson Falls and Lewistown. The object of this system of wireless is to supplement the regular telegraph and telephone service between these stations and to enable the company to remain in communication with the various stations when the regular channels of communication are interfered with by storms and accidents and when it is all the more necessary to send out men to make necessary repairs and thus reduce the period of interruption of service.

Tuolumne-Main Range Controversy has been engaging considerable attention in Butte during the last week. Ever since Tuolumne undertook to develop the properties of the Butte Main Range company in the eastern section of the camp, a group of stockholders of the Main Range company have manifested dissatisfaction with the arrangement by which the Tuolumne company is to acquire the stock of the Main Range company and the manner by which, it is alleged, the first named company is claiming credit for enhancing the value of its stock through the splendid showing disclosed in the Main Range properties. Within the last few days both sides have announced their view of the transaction, with the object of clearing up any misunderstanding that may linger in the minds of stockholders in either company.

DENVER—Mar. 22

Colorado School of Mines has recently established one free scholarship per year to one student from Mexico, and from each Central American and South American Country, in the belief that this action will foster universal mining education and will provide greater exploitation of the mineral resources of those countries. The School's regular winter course for prospectors is still in session; the attendants represent widely separated portions of our country, including two ladies and range in age from 18 to 64.

SALT LAKE CITY—Mar. 23

Large Deposits of Oil Shale in Unita County have been made the subject of Government reservation. The acreage involved—2,511,517 acres—is not entirely withdrawn from entry, but in each case where land is to be taken up, examination will be made for possible oil shale. The shale in most cases lies in thick layers almost directly below the surface and the deposits are believed to be of great value. The proving of deposits of value will undoubtedly bring increased activity to the Unita basin; with the development of the oil fields railroad communication would follow, and another productive section of Utah opened. The most feasible railroad into this section would probably be a branch line from the Denver & Rio Grande from Soldiers Summit.

WALLACE, IDAHO—Mar. 19

Restraining Order Against Federal Mining and Smelting Co. was not granted by Judge Deitrich, of the United States district court, on the application by the Star Mining Co., which sought to restrain the Federal company from extracting ore from the Star ground pending the conclusion of the litigation over the ownership of the vein, details of which were given in the last issue of the "Journal." The court, however, ordered the Federal company to render a complete account of all ore that has been extracted from the ground in controversy and all ore that is hereafter extracted and file the same with the court. The court took into consideration the unfavorable terms of the smelting contract under which Federal ores are shipped to the American Smelting and Refining Co., which controls the Federal, as compared with contracts with independent smelters, and took as a fair example of independent contracts that of the Hecla Mining Co. with the International Smelting Co., ordering the Federal company to deposit with the court the difference that would have been received if the ore in question had been shipped under the terms of the Hecla contract. The Star company has started work on its property, the purpose being to accomplish certain development work to demonstrate the apex of the vein within its lines.

Suit Over Hercules Mine Value has been filed in the United States district court at Boise, by Mrs. Mathilde Cardoner, widow of the late Damian Cardoner, who was the owner of a ⅛ interest in the Hercules mine. The complaint states that Mrs. Cardoner was induced to sell the interest left to her and her daughter to Eugene R. Day and Eleanor Day Boyce for $370,000 through false representations made by Harry R. Allen, of Wallace, who came to her as a friend, but who she subsequently learned was in the employ of the defendants; that Allen represented to her that the Hercules was practically worked out; that the mine did not pay dividends for four months while lead was so high; that members of the Day family were speculating in the metal market with the mine's money and were likely to lose everything they had; that they were bucking the Guggenheims in the smelting business; that the Guggenheims had too much money for them and that the Days would be crushed; that other claimants under a former will of her husband were likely to cause trouble and possibly get her interest in the mine unless she converted it into cash. Upon these representations he is alleged to have advised her to sell her interest as speedily as possible, for if she did not do so her interest would soon become valueless; that the mine was not worth to exceed $5,000,000. In consequence of these representations on Oct. 27, 1916, she empowered Allen to sell her interest in the mine for $312,500, her interest in the cash on hand for $37,500, and certain property in Burke for $20,000, totaling $370,000. From subsequent information Mrs. Cardoner alleges that the Hercules mine was at the time worth $20,000,000, and that the company had acquired large interest in a smelting and a refining plant and that the entire Hercules holdings were worth $30,000,000, in which her interest was entitled to share. After gaining a fortune in the Hercules, Damian Cardoner returned to Barcelona, Spain, his native land, and he died at Las Palmas, Canary Islands, in February, 1915. Mrs. Cardoner alleges that being unfamiliar with her husbands affairs, and having confidence in Eugene R. Day, manager of the Hercules mine, she desired his appointment as administrator of the estate, and he was so appointed in July, 1915. She further alleges that the representations made by Allen were incited and suggested by Eugene R. Day for the purpose of deceiving and alarming her, and causing her to sell her interest at an inadequate price. The filing of this action has caused a real sensation and the trial is expected to bring out some startling revelations. In an interview in Spokane, Harry L. Day suggests that Mrs. Cardoner is only a figurehead in the matter and that other interests are back of the suit.

JARBIDGE, NEV.—Mar. 16

The Wingfield Interests have the Elmore group under option and have 15 men working on development under the direction of J. O. Greenan. Legitimate Mines Co. is working 10 men on development under the direction of A. T. McCauley. The total payroll of the Jarbidge camp will approximate $35,000; about 250 men are employed, the town having a population of 800. It would be conservative to say that there is approximately eight or ten million dollars worth of ore in sight in the district. An interesting feature is the persistence of the oreshoots in the rhyolite formation; the entire country for some miles around being a recent rhyolite flow.

Considerable Change in Jarbidge was effected by the entrance of the Guggenheim interests, the camp generally having taken on an air of activity and expectancy such as has not been felt for a number of years, and it now seems as if the district were assured of adequate development. The Elkoro Mines Co., a subsidiary of the Yukon Gold Co., has taken over the Hanford interest in the development at the Starlight, Jarbidge Gold and Flaxie mines. These properties have been under development by the Hanford interests of San Francisco for eight months, with about 50 men working under the direction of N. M. Muir. The Starlight is opened by three adits, which have disclosed three shoots of ore, with a depth of about 350 ft., an average length of 125 ft., and an average ore width of 5 ft. The general value reported is $15 a ton. The Long Hike mine, which was the first and principal holding of the Elkoro company, is developed by four adits, having a proven depth of vein of 650 ft., an average width of about 8 ft., and a proven oreshoot of over 800 ft. It is understood that the average value is $20; about 150 men are employed on the Long Hike. All of the work of the Elkoro Mines Co. is under the direction of E. A. Austin, resident manager. The company has now six properties; namely, the Long Hike, O. K., Buckeye, Flaxie, Starlight and Jarbidge Gold.

DULUTH, MINN.—Mar. 21

Tonnage-Tax Bill Defeated in the Senate by a vote of 40 to 27. The bill provided for a supertax of 2% on all merchantable iron ore at the mouth of the mine. It passed the house in February by a vote of 69 to 61.

To Maintain Order throughout the state, the subcommittee of the labor committee of the house has sent to the committee its recommendation for the creation of a state fund to aid counties of slender means to fight the I. W. W. activities which have in the past resulted in disorders and violations of the law. The report states that it believes that the principle of collective bargaining should not be discouraged by employers of labor and that the failure to recognize this right was responsible, to a great extent, for the labor disturbances in northern Minnesota, which were aggravated to an alarming degree by activities of the organizers and members of the Industrial Workers of the World, whose doctrine of criminal syndicalism, advocating violence, sabotage and various unlawful methods of terrorism, tended to inflame the passions of men to acts which undermine the very foundations of order and government. The subcommittee recommends a state-law-enforcement fund, to be used in giving counties of this state sufficient financial assistance with which to procure enforcement of the laws, but permitting the use of such fund only by counties not able to defray such expense.

IRONWOOD, MICH.—Mar. 23

Fearing I. W. W. Agitation on the Gogebic Range, this year, the business men of Ironwood have adopted resolutions condemning the activities of this organization on the Lake Superior Iron ranges. I. W. W. men have been active in and about Ironwood for several weeks and meetings have been held in different parts of the Gogebic range. The action of the business men, however, will probably be a big factor in changing

the minds of some of the miners who have thought of leaving their work. They will get little sympathy from the owners of stores, who realize that the I. W. W. has invariably brought about loss of time and money in every district in which it has operated. Agitators are also working on some of the other ranges, but it is not believed that there will be any strike in the Michigan field. It is thought that some trouble may arise on the Mesabi range or at the docks.

JOPLIN, MO.—Mar. 24

Present Cost of Mine Development in the Joplin district is illustrated by the fact that the Blue Mound Mining Co. has announced that in January, this year, it just put its first ton of concentrates in the bin at a cost of $125,000. The property is situated in Kansas, just across the state line, north of Picher, Okla. Drilling was started almost a year ago and development pushed but the mill was not able to start until January. It is a 300-ton plant, with 18 slime tables. William Kenefick, of Kansas City, and L. P. Buchanan, of Joplin, are principal owners.

Investments in Kansas-Oklahoma Section of the district have been heavy in the last two weeks. As one instance, may be cited S. Y. Ramage, of Oil City, Penn., who for several years operated a sheet-ground mine north of Carterville, and two years ago developed a tract west of Joplin. Recently, he has bought the B. L. & G. property at Century, a sale previously reported, wherein the consideration was $125,000. Immediately afterward he bought a 40-acre tract on Grace Sacto land, one-half mile southeast of Picher, Okla., for $105,000. And a few days later he bought the first lease on a quarter section of the Cooper estate, west of Baxter Springs, Kan., paying $38,500. He will build a mill on the B. L. & G. ground and two on the Sacto lease, and will drill thoroughly the Cooper land.

WASHINGTON—Mar. 27

Gases from Rotting Timber are thought to have been the cause of the death of the two men who recently were suffocated in the Adventure copper mine, at Greenland, Mich. At the request of the operators, the U. S. Bureau of Mines has dispatched H. I. Smith, a mining engineer connected with the Urbana, Ill., station, to make an investigation.

Mining engineers and chemists throughout the United States are to be called upon by the U. S. Bureau of Mines to coöperate in collecting information with regard to the particular fitness of each engineer for service in case of war. In this way it is expected to establish how and where the service of these men could be of most use to the country. Blanks are to be sent out soon calling for detailed information as to the special qualifications of each engineer. This information will be assembled and classified at the Bureau of Mines.

Nickel and Cobalt are to be the subjects of intensive study by the U. S. Bureau of Mines under the direction of Carl E. Julihn, of Alameda, Calif., who has just been appointed a mineral technologist at a salary of $3600 per annum. The principal aim of the work is to ascertain the possibility of obtaining a domestic supply of these minerals. This will involve a thorough study of methods of production. The work will be conducted at Golden, Colorado.

Dust and Fume Collection is to receive increased attention from the metallurgical division of the U. S. Bureau of Mines. With the introduction of flotation and the finer grinding which goes with it, the dust losses at smelteries have increased decidedly. To meet this, extensive alterations are being planned by several smelters. Some operators already have made installations looking to a greater dust and fume recovery. It is the object of the Bureau of Mines to ascertain more definitely the value of the various methods for reducing dust and smoke losses, and it also is hoped that this research may add something to the knowledge already possessed of this problem.

THETFORD MINES, QUE.—Mar. 14

Chrome Mining has again revived after a suspension of about 10 years. In contrast to shipping practically all in concentrates, as formerly, the ore is now nearly all shipped in the crude state, with a chromic-acid content of from 25 to 40%. Most of the ore is shipped to the United States to be used as furnace linings in the steel industry. Of these grades there was shipped about 15,000 tons in 1916. The Mutual Chemical Co. of America, of 55 John St., New York, has completed two concentrating plants in the Black Lake district, with a capacity of 5 tons per hour each; the Caribou plant is the old style stamp mill, while the Lake St. Francis plant uses the ball mill for secondary crushing, and the Dorr thickener and Wilfley tables for handling the fine material. The efficiency obtained at the latter plant has been highly satisfactory. A noticeable migration of American mining men into the province has been caused by the expansion in the industries and to take the place of those who are absent on military duties.

Asbestos Industry of Quebec is exceedingly prosperous; the important issues in this field at present are: High prices ruling for production; questions arising from the labor situation; and transportation by rail and water. A serious shortage of coal was threatened for a time, but conditions have again become normal and operations were suspended only for a short time. Asbestos being in a large measure required for admiralty work receives preference over many classes of goods. The condition of the labor market is also more satisfactory than in many of the mining centers throughout Canada. In spite of the abnormal prices of the last two years there has been little done in the way of opening new properties or reopening those which have been closed down since the boom of 1908-11. At present two of the more promising properties are being reorganized to begin operations in May and June—the Fraser property by the Asbestos Corporation of Canada and the old Ling Asbestos Co. taken over by New York interests and operated under the name of the Quebec Asbestos Co. These are both at East Broughton and are producers of low-grade fiber. This class of low-grade mine has never been able to produce dividends but it is held that with present high prices and the more efficient mechanical separation of present-day milling methods, much better results can be obtained. The Dr. Reed mine at Black Lake has been organized as the Imperial Chrome Co. and has been operated for the recovery of crude asbestos. The Belmina Asbestos Mines at Coleraine is also being worked under the same system by J. M. Johnston of Black Lake.

TORONTO—Mar. 23

Industrial Preparedness is being forwarded through the recently organized Advisory Council of Scientific and Industrial Research. Following the American plan it is sending out a questionnaire to every Canadian university, technical society and manufacturer and all government departments engaged in research work. Manufacturers are asked to give confidential information as to what raw material they use and where they obtain it and whether they have research laboratories in connection with their plants. Among the more important problems which will be first considered by the council are the economic production of potash from feldspar, the briquetting of the lignite coal of western Canada, and the utilization of the extensive deposits of tar sand lying to the northwest of Edmonton. The council has received requests for their coöperation from private firms engaged in investigating these problems.

The Mining News

ARIZONA

Greenlee County

ARIZONA COPPER (Clifton)—February production 4,600,000 tons.

Mohave County

TELLURIDE CHIEF (Kingman)—Developing five veins of molybdenum-copper-gold-silver ore, mill tests of which have indicated molybdenum concentrate averaging: MoS_2 64.45%; Fe 5.48; Cu 0.50; SiO_2 23.45% and "traces" of arsenic, barium and phosphorus. Heavier mine equipment to be installed includes: A 500-cu.ft. air compressor; 100-hp. semi-Diesel engine, 60-hp. hoist, 35-hp. engine and generator, sinking and station pumps; four Jackhamer drills. The 200-ft. shaft will be extended to 500 ft. and a 100-ton flotation mill will be erected. Roy L. Cornell, resident engineer; G. R. Hannan, general manager. Main office, Hass Bldg., Los Angeles, Calif. Mine, 20 miles southeast of Kingman in Maynard mining district.

Pima County

AJO CONSOLIDATED (Ajo)—Reported sale of this property to New Cornelia on $12,000,000 option denied.

AJO CORNELIA COPPER CO. (Ajo)—Sinking of double-compartment shaft stopped and will be superseded by diamond-drill work, E. J. Longyear Co., of Minneapolis, Minn., having contract. Property comprises 27 claims; about 1 mile south of Cornelia. Edward J. Grant, president.

Pinal County

UNITED STATES VANADIUM DEVELOPMENT (Kelvin)—High-grade vanadium ore reported in raise connection recently completed between upper and lower tunnels. Dr. E. Payne Palmer, of Phoenix, president.

Santa Cruz County

LOWER CALIFORNIA METALS (Nogales)—Flotation mill, 2½ miles north of Nogales, nearing completion. To be electrically driven.

Yavapai County

CALUMET & JEROME (Jerome)—Three-compartment shaft now over 250 ft. deep. Camp buildings recently completed; also water- and oil-storage tanks. Principal equipment includes: A 325-hp. McIntosh-Seymour Diesel engine; 200-kv.-a. Crocker-Wheeler generator; 513-cu.ft. Imperial air compressor; Lidgerwood double-drum electric hoist for depth of 1600 ft.; Leyner No. 5 drill sharpener.

CALIFORNIA

Amador County

STATE HIGHWAY LATERAL from Jackson to Herold will be built; Amador County board of supervisors have appropriated money for survey; will make direct connection with main highway between Stockton and Sacramento and with Southern Pacific R.R.

CONSOLIDATED AMADOR (Sutter Creek)—Water in shaft lowered to 1725 ft. The débris and muck in the bottom of the shaft will require use of pick and shovel. Expects to have large hoist in use in few days. Considering delays in receiving machinery, the reopening has been accomplished expeditiously. T. Walter Beam, manager.

BUNKER HILL (Amador)—Shaft repairs in progress and bend in lower end of shaft straightened. This, with the concreting at the collar for a depth of 225 ft., makes the Bunker Hill one of the best working shafts on the Mother Lode. The 40-stamp mill running steadily. E. Hampton, who has been superintendent for several years, has resigned to accept a similar position in Nevada County.

Butte County

RICH QUARTZ POCKETS reported by Cox & Parker of Yankee Hill while prospecting in the Jordon Hill district. Ground in vicinity better known for gravel mining, and discovery of quartz pockets was a surprise. Some nuggets worth $15 each.

GRUBBS PLACERS (Oroville)—Ten-year lease granted to Charles Mooney by John Grubbs on placer ground in Fine Gold, Kitchen and Scott Whipple ravines.

SURCEASE (Oroville)—Property situated in Big Bend district reported optioned by Eastern men. Development started and good ore disclosed. J. H. Kinkaid is in charge.

Eldorado County

CHURCH-UNION (Placerville)—Property near Eldorado, recently taken over by H. H. Lang, of Mill Valley for $10,000, has been conveyed to the Oakland Bank of Savings and Loan.

EL DORADO EXPLORATION CO. (Placerville)—This Seattle company driving crosscut tunnel; cut 26-ft. vein at 150 ft. in Hot Spur claim, south of the old Church-Union mine; drifted 50 ft. along east wall of vein; raise to surface contemplated; also mill. John W. Cover, in charge.

Inyo County

LOST BURROS (Bonnie Clare, Nev.)—New 50-ton mill being installed by Montana-Tonopah Mining Co. at this mine 50 miles west in Ubehebe district on western edge of Death Valley. Considerable ore in bins. Ore formerly hauled by tractors to the railroad.

CALIFORNIA ALKALI CO. (Keeler)—Organized to construct works at southern end of Owens Lake to manufacture soda ash and other products from waters of lake. Permitted to sell 2000 shares preferred stock for $200,000 and to issue 15,000 shares common stock in payment for secret processes and services rendered in exploration and promotion. Cement and lumber on ground and construction begun. Plant expected to be in operation in July.

Nevada County

SIGNAL (Grass Valley)—Cornish pump installed and shaft sinking in progress at this former producer.

WEEKS (Rough and Ready)—Steam hoist will be displaced by modern electric plant. Shaft deepened from 200 to 400 ft., since property was

optioned by Salt Lake men. Careful sampling now in progress. Dow Young in charge.

Sierra County

WIDE AWAKE (Downievil'e)—Under option to Thomas Wilson and Reno associates. Contract let for 100 ft. more tunnel to tap channel.

OXFORD-GOLD BLUFF (Downieville)—Work resumed with two shifts driving development tunnel. Cliff Leasing Co., Salt Lake, operating under bond.

Shasta County

NUGGET, valued at $54.60, found recently in Old Diggings district by William Elmire after a heavy storm. District has been mined and prospected for 60 years, following the heavy winter rains, prospectors usually finding coarse gold.

RUSSELL PLACERS (Igo)—H. W. Turner is prospecting this ground to ascertain if it will warrant installation of a dredge by an Oroville company.

MOUNTAIN COPPER (Keswick)—New Year mine, adjoining Balaklala property, reported to be producing. At the Iron Mountain mines, arrangements made for increasing shipments to Martinez smeltery.

ARPS COPPER CO. (Redding)—Will operate Arps group of copper-zinc claims at Copper City on the north side of Pit River, near the Bully Hill mine. William Arps located and began development about the time Bully Hill was purchased by Captain De Lamar. His associates are Anton Jaegel and R. M. Saeltzer of Redding. Shipping ore by rail to the Mammoth smeltery at Kennett. Concentration by flotation or other method is contemplated. W. W. Henry Jr., superintendent.

Siskiyou County

GRAY EAGLE (Happy Camp)—Diamond drills, engines and boilers going in by freight teams via Ft. Jones; drilling will be in charge of D. Harrington. Entire summer will probably be occupied drilling on property controlled by the Gray Eagle.

MOLYBDENITE reported discovered in granite near Oak Bar on Klamath River. The farthest north that this mineral has heretofore been reported in California is in Shasta County. State Mining Bureau, "Bul.. 67," records occurrences of molybdenite also in Eldorado, Fresno, Inyo, Madera, Mariposa, Mono, Napa, Nevada, Placer, Plumas, San Diego, Tulare, Tuolumne and Riverside counties; no commercial production reported, except a small tonnage mined in Plumas County.

Tuolumne County

RAWHIDE (Jamestown)—Water in 1800-ft. shaft lowered to below the 1700 level. Another pump will be installed to complete unwatering. Exploration will follow. Pittsburg-Silver Peak Mining Co. operating. John Mocine, superintendent.

SPRINGFIELD TUNNEL (Columbia)—Special stockholders meeting increased capital from $500,000 to $1,000,000. C. A. Belli elected secretary. Drainage tunnel, run from cañon of Stanislaus River, will now be advanced to old workings at Springfield where rich gravel was indicated by drills in the Barry channel on the edge of Springfield Flat.

COLORADO

Clear Creek County

WESTERN TUNNEL MINING CORPORATION (Idaho Springs)—New company incorporated by W. H. Malone, J. H. Marshall, and L. B. Schartsell; principal office in Denver. Has taken over the Vindicator group of 34 mining claims, up Chicago Creek, and will commence development.

OTTAWA (Alice)—Acquired recently by A. Clark and associates of Denver. Mine is opened by about 2000 ft. of workings. A 300-ft. crosscut is to be driven. Pockets of high-grade gold ore found in upper workings.

Summit County

WASHINGTON (Breckenridge)—Shipments being made by lessees and sublessees; considerable milling-grade ore also being developed; contains gold, silver and lead.

IDAHO

Lemhi

SUNSET MINING (Leadore)—Shipped approximately 500 tons of lead-silver ore in February, and March shipments will approximate 1000 tons. Lately, 3-ft. vein of galena ore averaging 50% lead was opened, besides large body of 20% ore carrying about 15 oz. of silver. Alvin J. Smith, superintendent.

Owyhee County

CARBONIFEROUS (Hailey)—Acquired by Raymond Guyer, manager of the Rex Consolidated, of Wallace. Several months ago Mr. Guyer acquired the Black Barb group adjoining. Properties contain the characteristic lead-silver-zinc ores of Wood River district and development company is to be formed this spring for their exploitation.

Shoshone County

BUNKER HILL & SULLIVAN (Kellogg)—Regarding reported sale of this property to American Smelting and Refining Co., President F. W. Bradley telegraphs: "Negotiations have never been entered into as alleged and a sale is neither contemplated nor pending."

SUCCESS (Wallace)—Management announces that body of ore has been opened for 80 ft. on the 1400 level, which in places is 20 ft. wide. Shaft down to the 1500 and orebody will be explored on this level. Company has bonded property of Clayton Mining and Smelting Co., in Custer County, a high-grade lead-silver mine, upon which a 100-ton mill will be built at once.

RAY-JEFFERSON (Wallace)—New 400-ton mill, which has been running only a few weeks, was closed Mar. 18. Mine development was not far enough ahead to keep it running. About 50 men are retained in the mine and it is expected that sufficient ore will be available in a few weeks; controlled by Day interests. Railroad up Beaver Creek recently completed to the mill to handle shipments.

MICHIGAN

Copper

NEW BALTIC (Baltic)—Shaft down 90 ft.

OSCEOLA (Osceola)—Production for March will be lower than the average, due to severe snow storms during last week.

HANCOCK (Hancock)—Hoisting enough ore to supply 600-ton head at the Centenial-Allouez mill, and 500-ton head at the Quincy mill.

NEW ARCADIAN (Houghton)—Purchased new Sullivan WB-2 air compressor, having capacity of 18 drills; will give total capacity of 26 drills.

SENECA (Mohawk)—Sinking of three-compartment shaft approved by directors; proposed use of Mohawk No. 2 shaft, which is within 450 ft. of Seneca ground, abandoned. W. J. Uren, superintendent.

KEWEENAW (Phœnix)—Phœnix mill losing approximately 6 lb. copper per ton. To present equipment, consisting of four Overstrom and three Wilfley tables, four more Wilfleys will be added. No. 1 shaft bottomed at 16th level. Installation of some flotation process contemplated.

Iron

AMERICAN (Diorite)—Small stripping operation being carried on. Cave-in last summer exposed fair-sized body of ore which will be mined this summer.

QUEEN (Negaunee)—Ore supply will be exhausted in about two months. Will probably end the Oliver operations in Negaunee, where they formerly had a number of mines. The Stegmiller, at Princeton, will be closed by the same company this year.

MINNESOTA

Mesabi Range

MADRID (Virginia)—Mine working again. Ore being stocked. Small washing plant, begun some years ago, will be finished.

PEARSON (Nashwauk)—This mine, north of the La Rue and idle since 1913, has been leased to C. K. Quinn of Duluth; new shaft may be sunk.

JULIA (Virginia)—Operations resumed at this mine, formerly known as the Bessemer. Inland Steel Co. has lease. New equipment installed. Republic Iron and Steel Co. worked mine until two years ago.

DUNWOODY (Chisholm)—This openpit mine will be operated by the Orwell Iron Co.; Bruce Middlemiss of Hibbing will be general manager. Orwell company controlled by Inland Steel Co. and Tod-Stambaugh interests.

SHENANGO (Chisholm)—Steam shovels will be used for last time this year; pit getting too deep. An incline will be built to a pocket in the center of pit. Ore will be milled and trammed to pocket by small gasoline locomotives. New electric hoist to be installed and 1200-gal. electric pump ordered, to replace steam pump. Entire cost of new equipment about $250,000.

MISSOURI

Joplin District

ARISTA (Wentworth)—New mill about completed on tract 3 miles southeast of Wentworth. Equipped with oil engines.

AFTON MINING (Afton, Okla.)—Made fair find in third hole in drilling campaign, indicating that ore exists as far south as Afton.

PICHER GOODRICH (Picher, Okla.)—Picher Lead Co. has this new mill—it's fifth—well underway. Besides other modern equipment, it will have largest thickener plant in district—two 50-ft. Dorr thickeners.

CLIFF (Joplin)—New 200-ton mill almost ready to operate in Leadville Hollow, northwest of Joplin. Cecil C. Fennell, of St. Louis, and V. C. Erman, Pittsburgh, Penn., principal owners. Is 200-ton per shift mill.

CENTRAL (Tar River, Okla.)—Refused $400,000 for lease and mill just completed. Ground not opened up, but two shafts down, showing rich ore. Southeast Missouri investors owners; H. W. Geissing, secretary.

BIG CHIEF (Picher, Okla.)—Contract let for new 250-ton mill by L. W. Moore and associates, of Kansas City. Lease owned and developed by A. E. Bendelari, mines manager for Picher company. It is between Picher Netta and Picher Goodrich mills. Shaft sunk into rich ore.

D. A. McCALLUM, (Joplin)—Purchased lease of 224 acres west of Commerce, Okla. Long considered out of producing field, but recent drilling showed several good drill holes.

WAMPLER (Webb City)—Drifting in new shaft on lease south of Duenweg resulted in rich find of ore similar to that worked by Baltic mine, short distance to north. Company has purchased Babcock mill, north of Joplin, and will move it to new strike.

SLIM JIM (Picher, Okla.)—Tract of 51 acres, first lease, sold to National Zinc and Lead and Milton Mining Co. for $40,000. First mentioned company will develop 30 acres and Milton 21. National will move Google mill now at Prosperity, Mo., to tract. H. F. Sanborn, Joplin, general manager. Slim Jim company put down 18 drill holes, and shaft 165 ft.

MONTANA

Cascade County

BUTTE & GREAT FALLS (Neihart)—Since discontinuing operations at its Butte properties, company has done extensive development work at its Neihart mines. By Mar. 1, about 10,000 tons of commercial ore were blocked out; and several shipments made since. New stope, just opened, disclosed ore averaging 18% zinc, 10% lead and 8 oz. silver, with a small amount of gold. As soon as new compressor is installed 50 tons will be shipped daily. Company will probably erect mill. May add to holdings.

Fergus County

BARNES KING DEVELOPMENT (Kendall)—Bullion production of North Moccasin at Kendall, and of Piegan-Gloster and Shannon at Marysville, Lewis and Clark County, totaled $81,435 in February. Out of this $10,574 was paid on Shannon property and $30,000 on outstanding notes. Out of total, Moccasin produced $20,635 from 3278 tons of ore. Piegan-Gloster and Shannon produced $60,800 from 5028 tons of ore.

Lewis and Clark County

MARYSVILLE GOLD (Marysville)—Mill contemplated to treat ore reported developed in various properties of company above Marysville.

ST. LOUIS MINING (Marysville)—Work at mine and mill progressing to a point where permanent operations will soon be started. Electric machinery installed to operate mill and mine, power being obtained from the plant at Hauser Lake, north of Helena. Ore reported in the old Drumlummon and new strike of high-grade ore was made recently.

Madison County

IN VIRGINIA CITY DISTRICT, Butte men have bonded Pennington copper group in Ramshorn Gulch; idle for 20 years. George W. Knight has leased Paymaster mine near Sheridan. J. M. Jackson of Spokane, Wash., who has bonded Grand View mine, expects to ship soon wulfenite ore. J. O. Carpenter of Detroit, Mich., is completing cyanide plant for Lake Shore group at head of Wisconsin Creek.

Silver Bow County

DAVIS DALY (Butte)—More glance ore encountered on 2400 level; vein over 12 ft. averages 8% copper.

BUTTE & SUPERIOR (Butte)—During February, 43,216 tons of ore were treated in flotation section of company's mill, producing 9980 tons of concentrates. Average cost $5.55 per ton; value of concentrates recovered $50 per ton.

BUTTE & ZENITH CITY (Butte)—Shaft sinking resumed Mar. 20; will be extended from 1000 to 1500 level where property will be further explored. Crosscutting on 1000 level developed promising conditions, although commercial ore in quantity was not found on that level.

ANACONDA (Butte)—Fires at company's Butte mines still causing considerable trouble, particularly in the Tramway mine, although situation there is gradually improving; output from West Colusa and Leonard mines has nearly reached normal figures. Sinking at the Bonanza mine in southwest part of district has progressed to below the 300-ft. level. Although company did not pay the $10,000 due Mar. 16, on the option on the Douglas mine in the Cœur d'Alene district, Idaho, and did not ask for an extension of the time for payment, it is understood, company will continue operating property under lease, which was given independently of the option and has until Dec. 16, 1918 to run; company paying royalty of $3 per ton or $150 per day on ore shipped and is carrying on extensive development; it is assumed company may purchase property under terms of lease, paying the total at expiration of lease rather than in installments under the option.

NEVADA

Esmeralda County

GREAT BEND (Goldfield)—Sixth carload of ore from stope at top of 300-level raise returned $45 per ton; seventh car being loaded.

SILVERMINES CORPORATION (Hornsilver)—The 60° inclined shaft, now down to 400-ft. level, will be sunk to the 800 level during building of 100-ton cyanide mill. Company reports present

ore reserves as 20,000 tons averaging over $15; ratio of silver to gold, 80:1. Milling equipment will include: No. 4 Wheeler force-feed crusher, breaking to 1¼ in., at the shaft; belt conveyor; Chalmers & Williams ball mill, 6 ft. diam. by 4 ft. long; 4-ft. Dorr classifier; Dorr thickeners; oversize ground in two 4 x 16-ft. Colorado Iron Works tube mills; replacement process carried out in Dorr agitators. All mill equipment motor driven, power being obtained from 200-hp. Fairbanks-Morse semi-Diesel engine burning 24-gravity crude oil, and a direct-connected 150-kv.-a. General Electric generator. Main office, Nixon Building, Reno; S. H. Brady, president.

Lander County

COPPER CANON (Battle Mountain)—R. P. Davidson has hauling contract; is using 75-hp. caterpillar tractor and hauling 25 tons a trip 9 miles to Nevada Central R.R.; two trips daily. Expect to double load when roads are better.

Lyon County

NEVADA DOUGLAS (Ludwig)—During first half of March, shipped 2600 tons to Thompson and 1750 tons to Utah smelteries.

Nye County

TONOPAH ORE PRODUCTION for week ended Mar. 17, was 9614 tons, valued at $177,859, as compared with 9318 tons for the previous week. Producers were: Tonopah Belmont, 2974 tons; Tonopah Mining, 2250; Tonopah Extension, 2380; Jim Butler, 750; West End, 628; Rescue, 250; Halifax, 165; Montana, 133; Midway, 30; North Star, 54 tons.

MORNING GLORY MINING (Manhattan)—Has started its shaft, about 60 ft. from White Caps side line.

MANHATTAN RED TOP (Manhattan)—Reorganized and has started work; north of the Dexter-Union property.

MANHATTAN CONSOLIDATED MINES DEVELOPMENT CO. (Manhattan)—Contract let to sink shaft 200 ft. farther; three shifts working.

TONOPAH BELMONT (Tonopah)—February net earnings were $104,609 from 10,975 tons yielding 2079 oz. gold bullion and 199,254 of silver.

TONOPAH MINING (Tonopah)—February net profits at Tonopah were $21,030 from 8042 tons. Bullion shipped 105,670 oz.; value about $100,000.

AMALGAMATED EXTENSION (Manhattan)—This new company, formed by L. L. Musbett, C. F. Wittenberg and John E. Gregory, has bought the Buckboard and the Good Luck Fraction, west of Litigation Hill.

Storey County

CON. VIRGINIA (Virginia)—Saved 77 cars of ore assaying $8 per ton from 2700 level. Further development since disclosed ore assaying $15. First ore mined on 2700 level in history of the Comstock.

UNION CON. (Virginia)—Saved 10 tons of ore on 2400 level, sampling $11.63 and 113 tons, $17.51; on 2500 level, 16 tons, $18.51; 82 tons, $19.15; 92 tons, $24.80. On 2600 level, 2500-2900 winze saved 5 tons sampling $118.40. Sent to mill from mine and surface storage 518 tons sampling $15.90 per ton.

Washoe County

OLINGHOUSE DISTRICT is attracting attention of many small operators. It is along southern border of county, 7 miles from Derby on the Southern Pacific and 9 miles from Wadsworth, from both of which daily stages are run. J. Effrick and George Dallimore, who have lease on Slipp mine and the custom mill, are taking out ore steadily; some $60 gold ore being mined. Malherby & Co., leasing on the No. 2, are sinking a winze from the 100 level, where they struck body of low-grade ore. Lameux, who has developed the Renegade, is now taking out gold ore of fair grade. Maffe & Co., leasing on the Olinghouse property, recently milled 45 tons, and are still working in high-grade gold ore. Dondero & Co. renewed their lease on the Dondero, Cabin and V claims, and have about 50 tons of $20 gold ore on dump, awaiting shipment to the custom mill when the roads are dry. Ferretto Brothers have obtained two-year lease on the Keystone Milling and Mining Co. property. Illinois Mining Co. has begun development, installing small temporary gasoline hoist; contractors sinking main shaft. G. Shavee, in charge of Buckeye Buster Mining Co., recently shipped 21 tons of high-grade silver ore, and more is in sight. Practically all of these operations are near the surface and from present indications camp has prosperous future.

NEW MEXICO

Grant County

HANOVER-BESSEMER IRON AND COPPER (Hanover)—Recent fire destroyed only old trestle; no new construction damaged. Loss about $4000; insured.

Santa Fe County

NEAR GOLDEN, in southwestern part of county, the Yuba Manufacturing Co. of San Francisco, Calif., will construct for the Santa Fe Dredging Co. a 5-cu.ft. gold dredge, to dig 40 ft. below water line. It will have wooden hull, but modern machinery with latest type California buckets and Yuba pumps. Construction to be completed this summer; digging to start in November.

PENNSYLVANIA

AMERICAN STEEL AND WIRE CO. (Donora)—A portion of the zinc-oxide plant has been put in operation.

SOUTH DAKOTA

Lawrence County

ORO HONDO (Deadwood)—After spending a year in diamond drilling from 2000-ft. depth, shaft is being sunk another 1000 ft.

AMERICAN MINING CORPORATION (Flatiron)—Mill is in continuous operation though at reduced capacity. New oreshoots being developed and plant will soon be treating full capacity of 200 tons daily.

Pennington County

AMERICAN TUNGSTEN (Hill City)—Concentrator is handling about 90 tons of tin ore daily from the Cowboy. Custom ore from the Cummins tungsten property will also be treated.

GOLDEN SUMMIT (Hill City)—Shaft, now 230 ft., will be continued to 250 ft., where lateral work will commence. Shaft sinking will be resumed as soon as station is cut. Mill may be remodeled and operated this coming summer.

UTAH

Beaver County

LEONORA (Milford)—Proposed increase of 500,000 shares in capitalization (at present 1,000,000 shares) voted down at stockholder's meeting. Development at property progressing. Equipment adequate for present.

KING DAVID (Frisco)—Ore reported in west workings. East-west fissure from neighboring Horn Silver passes through property. Company holdings extensive. The Knights, of Provo, are interested.

Juab County

GEMINI (Eureka)—Dividend of $25,000 or $5 a share announced. Production for 1916 was 518 cars of ore; February, 44 cars. Present output about 2000 tons monthly.

EUREKA MINES (Eureka)—Shipment of 50 tons made, to afford basis for smelting contract, ore coming from near 1200 level. Development being done throughout property.

IRON KING (Eureka)—Expected to start work in April. Owns 500 acres south and southwest of Tintic Standard. Shaft—500 ft. deep—will be sunk, and drifting started to find continuation of Tintic Standard ore.

RIDGE & VALLEY (Eureka)—Ore being mined in increased amount from between 1600 and 1700 levels; 1500 level being developed. Work carried on through the Gemini. Intends to sink own shaft—now 800 ft. deep. Electric hoist to be installed. Under same management as Gemini.

DESERET MOUNTAIN (Tintic) — Company owns 250 acres—12 claims—and has bonded two more claims. Good tonnage of copper ore blocked out. Property opened by three shafts, deepest of which is 218-ft. inclined shaft. Some drifting done. Recently lead-silver ore of good grade reported opened on 127-ft. level. W. Mont Ferry, of Salt Lake City, president.

EAGLE & BLUE BELL (Eureka)—Production for first three weeks of March, 61 cars; daily rate, 150 tons; heavier than ever before. Monthly profit stated to be almost sufficient to meet quarterly dividend requirement—$45,000. Adjoining Victoria recently acquired, worked through this property, and daily tonnage of 50 tons from here hoisted through Eagle & Blue Bell shaft.

Salt Lake County

SHIPMENTS FROM ALTA are being increased; present rate is about 700 tons a week, the ore being hauled to Wasatch, and from there transported to the smelteries via the Salt Lake & Alta R.R., which goes up the cañon as far as Wasatch. Snow is still heavy in the cañon, and although temporary setbacks are expected from snowslides, regular shipments will be started before long, and continued throughout the shipping season. Operators in this camp have adapted themselves to climatic conditions so that there is now—through the careful location of mine buildings, etc.—practically no danger to life or property from snowslides. With the opening of the cañon, the construction of the narrow-gage line, which will connect Alta with the standard-gage railroad at Wasatch, will be carried on with greater energy. The line is completed for nearly a third of the way, to Tanner's Flat—from Wasatch 3 miles—with 6 miles more to go to reach Alta. This road, when completed, should afford considerable relief to shippers. During the winter season the mines are much hampered in getting their ores to market, from this camp, which is one of the highest in the state. Shippers are the South Hecla, Emma Consolidated, Michigan-Utah, Sells, etc. Winter operating conditions are similar in Big Cottonwood, which lies north across the divide from Alta. The chief shipper there is the Cardiff. At some properties in these camps, as well as in American Fork cañon, south from Alta, across the divide, ores are being accumulated, awaiting spring shipment.

GARFIELD SMELTING (Garfield)—Manager C. W. Whitley is quoted as saying that work of enlarging smelting plant 40% will be undertaken at once.

MONTANA-BINGHAM (Bingham)—Shaft down 167 ft. and is now in copper ore. Work being done on 200 level also. Tunnel—over 4000 ft. long—recently extended about 900 ft. under contract. T. B. Leggat, manager.

Summit County

JUDGE MINING AND SMELTING (Park City)—Sales in 1916 brought $839,455 from 17,000 tons of ore and concentrates. Mill treated 61,787 tons; second-class zinc concentrates were stored pending completion of electrolytic-zinc plant.

SILVER KING CONSOLIDATED (Park City)—During 1916 shipments amounted to 10,082 tons of ore valued at $500,498. Receipts—with balance of $232,644, Feb. 1, 1916—were $908,949. Dividends of $294,561 paid. Net gain for year $404,865. Surplus account, $341,962. Two towers of new aërial tramway blown down in heavy storm being repaired. February (1917) shipments amounted to 1000 tons of ore and concentrates.

Tooele County

DRY CANON has been active throughout the winter in spite of the heavy snows, which have at times almost entirely blocked the road leading out from the cañon. More than the usual amount of work at this season has been done, and shipments made in sleds. The Hidden Treasure, which has just finished sending to market 500 tons of zinc ore has a good accumulation on the dumps, ready for the market. The Mono and the Kearsarge are being worked by lessees; at the former there is ore on the dump awaiting shipment; at the latter development is being done, and shipments are to be made from old stope fillings.

CANADA

Ontario

MURRAY-MOGRIDGE (Wolf Lake)—Shipment of machinery on the way. Ore being blocked.

McCREA (Boston Creek)—Taken over by Shirley Ogilvie and Alexander McKinnon, of Montreal.

TRETHEWEY (Cobalt)—Groche flotation plant, recently installed, is understood to be giving satisfaction.

HUNTON-KIRKLAND (Kirkland Lake)—Vein, 7 ft. in width, stripped for 200 ft. Shaft in rich ore for 18 ft.

LARDER LAKE GOLDFIELDS (Larder Lake)—Encouraging results obtained on the 300 level, where considerable free gold is showing in quartz.

TEMISKAMING (Cobalt)—Main shaft at 1600-ft. level, connected up with workings of the Beaver, considerably improving the air circulation. Sinking will be continued to the 1800 level.

KIRKLAND LAKE (Kirkland Lake)—Vein at 500-ft. level stated to be from 20 to 30 ft. in width, with higher gold content than on upper levels. Shaft to be continued down to 600-ft. level.

McINTYRE (Schumacher)—Main vein at 1000-ft. level drifted on for 900 ft. Crosscuts at intervals average 28 ft. Drift will be continued to the Plenaurum property, on which the McIntyre holds option, in order to make explorations at depth.

BUFF MUNRO (Munro Township)—Development will shortly be begun on this 160-acre tract, one mile from the Crœsus, where mineralized veins, varying from a few inches to 4 ft. in width, have been found. J. G. Dodds, of Haileybury, in charge.

McKINLEY-DARRAGH (Cobalt)—Annual report for 1916 shows ore reserves estimated at 1,714,302 oz. as compared with 1,871,280 oz. on Jan. 1, 1916. It is stated that ore-bearing zone in eastern part of property has a greater depth than was formerly assumed. The third and fourth levels have been opened. Value of 1916 production, after deducting marketing costs, was $595,316; costs of production $290,679; gross operating profit, $304,637; net profit, $282,304, as against $236,656 in 1915. Surplus of assets over liabilities was $264,942. There were 62,676 tons of ore treated at the mill; extraction 82.39%. Operating costs were 40.73c. per oz.

NEWFOUNDLAND

HYDRO-ELECTRIC SMELTING CO. (St. Johns)—Developing an old copper property on Little Bay; operated by British company from 1878 to 1890. Driving adit, now in about 400 ft., to tap new area; will also be extended to old workings.

MEXICO

CIE. DU BOLEO (Santa Rosalia, Baja Calif.)—February copper production approximately 1,600,000 lb.; grade of ore 3.5%.

COLOMBIA

PATO MINES, LTD. (Zaragoza)—Another high cleanup reported; for 13 days ended Feb. 26, yield was $61,974 from 26,000 cu.yd. or $2.38 per cu.yd.

BELGIAN CONGO

UNION MINIERE DU HAUT KATANGA (Lubumbashi)—February copper production 2327 tons.

The Market Report

Metal Markets

SILVER AND STERLING EXCHANGE

Mar.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Mar.	Sterling, Exchange	Silver New York, Cents	Silver London, Pence
22	4.7553	72⅛	35⅞	26	4.7556	71⅞	35⅞
23	4.7556	72⅛	35 13/16	27	4.7556	71⅞	35 13/16
24	4.7556	71⅞	35⅞	28	4.7556	72⅛	36⅛

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Mar.	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
22	30½ @32	56¼	9 @9¼	8⅞ @9½	9⅜ @10½
23	30½ @32	56¼	9 @9¼	8⅞ @9½	9⅜ @10½
24	30½ @31½	56¼	9 @9¼	8⅞ @9½	9⅜ @10½
26	30½ @31½	56½	9 @9½	8⅞ @9	9⅜ @10½
27	30½ @31½	56	9 @9¼	8⅞ @9	9⅜ @10½
28	30½ @31½	55½	9 @9¼	8⅞ @9	9⅜ @10

The above quotations are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for cakes; ingots and wirebars. Electrolytic copper is commonly sold on "regular terms" (r.t.), including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 17c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

Mar.	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic	Tin Spot	Tin 3 Mos.	Lead Spot	Zinc Spot
22	136	135½	151	213	212	30½	47
23	136	135½	151	216	215	30½	47
24	...	...	...	...	...	...	...
26	136	135½	151	218	217½	30½	47
27	136	135½	151	218	217½	30½	47
28	136	135½	151	217¼	216¼	30½	47

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21¾c.

NEW YORK—Mar. 28

Copper was more active last week and was a little easier. Lead was fairly active, with about the same volume of business as in the previous week, and it also was easier. Zinc was dull, but fairly strong up to the close when it became softer.

Copper, Tin, Lead and Zinc

Copper—Decidedly more business was done than in the previous week, the aggregate of transactions being in excess of 18 million pounds, which is relatively small, but nevertheless, a good deal more than has been recorded in some recent weeks. The market was at sixes and sevens, however, owing to the great variety in the deliveries for which the sales were made. But it was clear that there was an easier tone in all positions. The tension in near-by copper was relieved by further easing of the freight congestion and further resales by consumers. April copper was reported sold at 34½c. and at the close, it was reported available at 34c., with May, at 33½c., and June, at 33c. Business in July was reported, done at 31½@32c., r.t. The major part of the business reported for the week was for delivery in the third quarter at prices ranging from 30½ to 31½c., r.t. There were free sellers at 30½c., r.t., and transactions at that price, but much of the business went to producers who were able to throw in something as sweeteners in the way of deliveries. Some sales for fourth-quarter delivery were made at 29½c., while there were sales for second half, one of them rather large, at 30c. Quotations were made on the 26th on a large foreign inquiry for delivery during the second half. At the close of the week, opinions of the market were very much mixed, some producers thinking that they could discern an improving tone, while others expressed an entirely opposite view.

The strike at the Nichols refinery was settled on Mar. 22, the advance of 2c. per hr. posted on the previous day having been satisfactory to the men, and the plant is now operating again at full capacity.

The market for brass is considerably easier and sharp competition among manufacturers is arising.

Copper Sheets—No change has been reported in the situation as described last week. We continue to quote hot rolled at 42@44c. per lb., cold rolled 1c. per lb. higher. Wire has been advanced and is now quoted 38@40c., f.o.b. mill.

Tin—Business in this market was very quiet. On Feb. 27, the price eased off under the influence of the arrival of 1815 tons in two ships, one from London and the other from Singapore.

Lead—Transactions were about the same in volume as in the previous week, about 3000 tons being reported. Business was chiefly for April and May, but a considerable volume of May-June was done. In the early part of the week a round lot for April shipment realized about 9.40c. at an interior point, but at the same time, April lead was offered in the New York market at 9¼c., and May lead at 9c., with sales at those figures. The premium on near-by shipments tended to vanish, and in the latter part of the week April was easily to be had at 9⅛c. This easier tendency is ascribable to the gradual relief from the freight congestion. Lead for May-June shipment was reported offered at 8⅞c., St. Louis, while later deliveries were offered speculatively as low as 8½c., New York, and in order to make such offers attractive, some near-by lead might be included.

There was some business in bonded lead for export during the week, inquiries being received from a great variety of sources, including Canada, Japan, Italy and France, especially the last two.

Zinc—This market continued very dull. In the early part of the week some second-quarter business was done at 9⅞c., and in the latter part, at 9¾c. Producers seemed anxious to place all the spelter ahead that they could, while the price for prompt and April was held up. At the close of the week, however, April-May spelter was offered at 10c.

Zinc Sheets—Price of zinc sheets has not been changed. Market remains at $21 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Metals

Antimony—There is practically no spot metal, hence prices are purely nominal at 34@35c. February-March shipment from China ranges from 20@25c. and March-April 15@16c., c.i.f., New York, duty unpaid.

Aluminum—The aluminum market has stiffened somewhat, but the strength is in anticipation of Government buying and not in actual increased business. We report no change from last week's figures. Nominal quotation is 58@60c. per lb. for No. 1 ingots, New York.

Nickel—The market remains steady at 50@55c. per lb. for nickel. Electrolytic commands an additional 5c. per lb. The International Nickel Co. has not changed its price, numerous press reports to the contrary notwithstanding.

Quicksilver—Market quiet and unchanged at $115@120. San Francisco reports, by telegraph, $115, firm.

Gold, Silver and Platinum

Gold—Gold coin to the amount of $50,000 has been withdrawn from the New York subtreasury for shipment to Spain.

Under date of Mar. 8, 1917, Samuel Montagu & Co., London, report that the German newspapers are already suggesting that in all probability silver will take the place of gold for domestic transactions after the war in their country. While it is practically certain that the internal circulation of gold will have to be suspended, it is very doubtful whether the substitute will be of so solid a character as silver.

Imports of gold for February, 1917, were $103,766,495 and exports, $22,068,059, leaving an excess in favor of imports of $81,698,436.

Gold to the amount of $5,000,000 has arrived at the New York assay office from Canada for account of J. P. Morgan & Co., bringing total imports from all sources to date this year to $225,700,000, and since Jan. 1, 1915, to $1,363,200,000.

Silver prices have fluctuated within narrow limits most of the past week, but jumping from 35⅛ on the 27th, to 36⅛ on the 28th. This rise in London is probably due to a special order, as business has been light and confined to buying for coinage without export orders. The imports of silver continue, restricted with a stock in London of about 5,000,000 oz. and any unusual competitive orders might cause a sharp rise in price.

Samuel Montagu & Co., London, under date of Mar. 8, 1917, report that the great demand that has existed in India for silver currency during the war did not become really keen until toward the close of 1915. This shows the close link that exists between the demand for currency and high prices for commodities. There is no reason to suppose that recent withdrawals of coin from circulation were other than what is customary, namely, the peasant classes have put by surplus profits against less favorable times. Now that prices have risen so considerably, the margin of profit is larger than usual, and a greater amount of coins is therefore necessary.

Mexican dollars at New York, Mar. 22, 55⅛c.; 23, 55½c.; 24, 55⅛c.; 26, 55½c.; 27, 55⅜c.; 28, 55¾c.

Platinum—Unchanged at $102½@105. Sales were reported at $102½.

Palladium—We quote $87½@92½.

Zinc and Lead Ore Markets

Platteville, Wis., Mar. 24—Blende, basis 60% Zn, $90 for premium ore down to $85 for medium grade. Lead ore, basis 80% Pb, $113 per ton. Shipments for the week are 2369 tons of zinc ore, 41 tons of lead ore, and 241 tons of sulphur ore. For the year to date the figures are: 30,191 tons of zinc ore, 917 tons of lead ore and 4837 tons of sulphur ore. Shipped during week to separating plants, 3462 tons of zinc ore.

Joplin, Mo., Mar. 24—Blende per ton, high $93.20; basis 60% Zn, premium ore $90, medium to low $85@75; Calamine, basis 40% Zn, $50@45; average selling price, all grades of zinc, $81.07.

Lead, per ton, high $119.35, basis 80% Pb, $115@110. Average selling price, all grades of lead, $117.93.

Shipments the week: Blende 7006 tons, calamine, 904 tons; lead 1513 tons. Value all ores the week, $819,720.

The lighter shipment reflects the short buying last week. Buyers were generally in the market this week for their usual quota, some of whom shipped a considerable portion of their purchases, made early in the week.

Production is being limited by the supply of labor, and each week a stronger call is made for additional men in the mines. Plenty of electric power, abundant gas and cheaper coal would permit a greater tonnage output, but for the shortage of labor.

Other Ores

Antimony Ore—This was very much in demand, but none was offered.

Molybdenum Ore—The market was a little firmer, $1.90 per lb. of MoS_2 having been paid for ore assaying 90%.

Tungsten Ore—The market was very active last week and the turnover was large at prices of $17@17.50 per unit. At the close, $17.50@18 was asked. We quote $17@18 for the week.

Charles Hardy reported under date of Mar. 27, that transactions of the week amounted to hundreds of tons, both for spot and early de-

livery and for forward shipment. This was the first time since the big drop in 1916, when consumers were willing to buy for shipment from South America.

Iron Trade Review

NEW YORK—Mar. 28

At this time steel makers are in conference and the prices at which steel mill products will be supplied to the Government are under discussion, says "Iron Age." Without regard to the concession which will be made, it is to be remembered that the total consumption for Government purposes does not bid fair to exceed 2% of the country's productive capacity. Much of it, of course, will get first attention, and by that fact penalize domestic consumers in respect to delivery and price.

Representing an effort to serve the Government with material without regard to other obligations of the mills, it is not yet believed that any price reductions are likely in future purchasing for the governments of the Allies. Signs are that general exporting will carry stiffer prices rather than otherwise.

Domestic buying has been of no inconsiderable magnitude in the last few weeks, in anticipation of the readiness with which a high market augments with a demand. And here there has been the specter of the Government with its great resources and the ultimate possibility of its needing material on a gigantic scale. One sign of the present distortion is a further delay in shipments of boiler tubes because of the Government program with its fleet of little as well as big ships.

A side light on the progress of the war is thrown by the receipt in this country of an inquiry for 200,000 tons of rails for Mesopotamia. Fresh lots of 40,000 tons are wanted by France and Belgium, and Java would buy 18,000 tons.

PITTSBURGH—Mar. 27

Transportation conditions have undergone a slight further improvement. Iron and steel production is increasing and stocks accumulated during the blockade are being moved. The steel market is fairly active, there being heavy bookings, of routine character, in the lines for which mill books are open. The American Sheet and Tin Plate Co. is expected to name prices next week on sheets and tinplate for second-half. The tinplate is already practically all preëmpted through September. Leading tinplate makers were in Washington last Friday conferring with the Department of Commerce, canners having represented that there is a shortage of tinplate. The mills assert that it is simply a case of an utterly abnormal demand. There is to be further investigation.

Arrangements thus far made with respect to steel for the Government has involved chiefly the speeding up of deliveries on steel ordered long ago, new orders having involved no large tonnage. The question is before the steel makers as to what they will do as to fresh orders, in view of the tender the copper producers made last week.

Steel prices continue to tend upward. Shafting and railroad spikes are higher. The Wheeling Steel and Iron Co. has advanced steel pipe about $10 a ton, effective today, but it is uncertain what other mills will do.

Pig Iron—Prices are up again and there is no sign of any arrest to the price movement. As was the case with the sharp advances from four to six months ago advances occur after only limited tonnages have been sold at a given price. Some conservative observers are predicting that $50 will be reached. In the past week bessemer has advanced fully $1 a ton and basic $3; a round tonnage of basic having gone at $35, valley. Production cannot increase much more, while with new steel capacity constantly coming in consumption is increasing and the entrance of the United States into the war is expected to make it easier for France and Italy to secure shipping facilities for the large tonnages they evidently need. We quote: Bessemer, $38@40; basic, $35@36; foundry, prompt, $38@40; forward, $36@37, all f.o.b. valley furnaces, 95c. higher delivered Pittsburgh.

Steel—The market is higher, billets being $70@75 for prompt shipment, with very limited offerings, and no quotations made for second half.

Ferroalloys

Ferromanganese—The predicted famine in prompt ferromanganese is developing rapidly, prompt being $400@450, while domestic on contract is offered only for fourth-quarter, at $300. Imported seems out of the question, deliveries being far behind and ore movement to England reduced.

Ferrotungsten—A considerable volume of business was placed and more is under negotiation.

Ferromolybdenum—Foreign buyers have again been in the market.

Coke

Connellsville—The market is easier as to spot, but operators are quite averse to selling for second half, conditions being so uncertain. We quote: Spot furnace, $8.50; contract, nominal, $7@8; spot foundry, $10.50; contract, nominal, $8@9, per net ton at ovens.

STOCK QUOTATIONS

N. Y. EXCH.†	Mar. 27
Alaska Gold M.	9⅛
Alaska Juneau	7⅛
Am.Sm.&Ref.,com.	104⅜
Am. Sm. & Ref., pf.	118
Am. Sm. Sec., pf. A	101⅛
Am. Sm. Sec., pf. B	‡95⅛
Am. Zinc	36⅛
Am. Zinc, pf.	69
Anaconda	83⅛
Batopilas Min.	1⅛
Bethlehem Steel	144
Bethlehem Steel, pf.	120⅛
Butte & Superior	45⅛
Cerro de Pasco	38
Chile Cop.	24⅛
Chino	57
Colo.Fuel & Iron	51⅛
Crucible Steel	69⅛
Dome Mines	18⅛
Federal M. & S.	18
Federal M. & S., pf.	40
Great Nor., ore ctf.	34⅛
Greene Cananea	42⅛
Homestake	126
Inspiration Con.	61
International Nickel	43⅞
Kennecott	45⅛
Lackawanna Steel	85⅛
Miami Copper	40⅛
Nat'l Lead, com.	61⅛
National Lead, pf.	112
Nev. Consol.	24
Ontario Min.	6⅛
Quicksilver	2⅛
Quicksilver, pf.	2⅞
Ray Con	29⅛
Republic I.&S.,com.	82⅛
Republic I. & S. pf.	102⅛
Sloss-Sheffield	70
Tennessee C. & C.	16⅛
U. S. Steel, com.	114⅞
U. S. Steel, pf.	118⅛
Utah Copper	111
Va. Iron C. & C.	69

N. Y. CURB†	Mar. 27
Buffalo Mines	1.30
Butte & N. Y.	1⅞
Butte C. & Z.	11⅛
Caledonia	.65
Calumet & Jerome	1⅛
Can. Cop. Corpn.	2
Carlisle	6
Con. Ariz. Sm.	2⅛
Con. Coppermines	4⅛
Con. Nev.-Utah	⅛
First Nat. Cop.	2⅛
Goldfield Con.	.57
Goldfield Merger	.07⅛
Granite	‡.25
Greenmonster	1⅛
Hecla Min.	7⅛
Howe Sound	6⅛
Jerome Verde	1⅛
Joplin Ore & Spel.	.30
Kerr Lake	4.35
Magma	46⅛
Majestic	⅛
McKinley-Dar-Sa.	.50
Mother Lode	.39
N. Y. & Hond.	14
Nipissing Mines	8⅛
Ohio Cop.	1⅛
Ray Hercules	4⅛
Rochester Mines	.58
St. Joseph Lead	‡18⅛
Seneca	12
Standard S. L.	1⅛
Stewart	.50
Success	.39
Tonopah	6⅛
Tonopah Ex.	3⅛
Tribullion	⅛
Troy Arizona	.60
United Verde Ext.	.28⅛
United Zinc	5⅛
White Knob, pf.	1⅛
White Oaks	2
Yukon Gold	1⅛

SAN FRAN.*	Mar. 27
Alta	.04
Andes	.11
Best & Belcher	.05
Bullion	.02
Caledonia	.11
Challenge Con.	.05
Confidence	.10
Con. Virginia	.14
Gould & Curry	.02
Hale & Norcross	.05
Jacket-Cr. Pt.	.03
Mexican	.05
Occidental	‡.65
Ophir	.11
Overman	.04
Savage	.05
Seg Belcher	.02
Sierra Nevada	.11
Union Con.	.32
Utah Con.	.01
Belmont	4.30
Jim Butler	.71
MacNamara	.07
Midway	.16
Mont.-Tonopah	.20
North Star	.15
Rescue Eula	.27
West End Con.	.67
Atlanta	.12
Booth	.09
Comb. Frac.	.05
D'field B.B.	‡.02
D'field Daisy	.03
Florence	.21
Jumbo Extension	.34
Kewanas	.18
Nevada Packard	.49
Round Mountain	.44
Silver Pick	.13
Argo	.05
Ariz. Central	.10
Big Jim	1.18⅛
Lazy Boy	.06
Nellie	.18
Tom Reed	2.06⅛
United Eastern	4.62⅛

BOSTON EXCH.*	Mar. 27
Adventure	3⅛
Ahmeek	101
Algomah	.90
Allouez	.65
Ariz. Com., ctfs.	13
Bonanza	.30
Butte-Balaklava	1⅛
Calumet & Ariz.	80⅛
Calumet & Hecla	550
Centennial	20
Copper Range	63⅛
Daly West	2⅛
Davis-Daly	6⅛
East Butte	14⅛
Franklin	8
Granby	86
Hancock	16
Hedley	15
Helvetia	.50
Indiana	3⅛
Island Cr'k, com.	67⅛
Isle Royale	32
Keweenaw	2⅜
Lake	13⅛
La Salle	3⅛
Mason Valley	5⅛
Mass	13⅛
Mayflower	2⅛
Michigan	4
Mohawk	87
New Arcadian	4⅛
New Idria	15⅛
North Butte	23⅛
North Lake	1⅛
Ojibway	2⅛
Old Colony	2⅛
Old Dominion	62
Osceola	93
Quincy	87
St. Mary's M. L.	84
Santa Fe	1⅛
Shannon	8⅛
Shattuck-Ariz.	28
So. Lake	4
So. Utah	.25
Superior	14
Superior & Bost.	6⅛
Tamarack	59⅛
Trinity	4⅛
Tuolumne	1⅛
U. S. Smelting	61
U. S. Smelt'g, pf.	50⅛
Utah Apex	2⅛
Utah Con.	15⅛
Utah Metal	5⅛
Victoria	4⅛
Winona	4⅛
Wolverine	44
Wyandot	1

BOSTON CURB*	Mar. 27
Alaska Mines Corp.	1⅛
Bingham Mines	10
Boston Ely	.65
Boston & Mont.	.64
Butte & Lon'n Dev.	.20
Calaveras	4
Calumet-Corbin	.02
Chief Con.	2⅛
Cortez	.20
Crown Reserve	.35
Crystal Cop.	.90
Eagle & Blue Bell	1⅛
Houghton Copper	1⅛
Intermountain	1⅛
Iron Cap Cop., pf.	15
Mexican Metals	.16
Mines of America	1⅛
Mojave Tungsten	.50
Nat. Zinc & Lead	.52
Nevada-Douglas	2⅛
New Baltic	1⅛
New Cornelia	18⅛
Oneco	.60
Pacific Mines	.25
Rex Cons.	.39

SALT LAKE*	Mar. 27
Big Four	.65
Black Jack	.05
Cardiff	4.75
Coloradio Mining	.08⅛
Crown Point	.04
Daly-Judge	8.50
Emma Con.	1.18⅛
Empire Copper	1.50
Gold Chain	.15
Grand Central	.52
Iron Blossom	1.22⅛
Lower Mammoth	.18
May Day	.10⅛
Moscow	.12
Prince Con.	1.25
Seven Troughs	‡.02⅛
Silver-King Coal'n	3.00
Silver King Con.	4.15
Sioux Con.	.14
So. Hecla	1.40
Uncle Sam	.03
Wilbert	.14⅛
Yankee	.11

TORONTO*	Mar. 27
Bailey	.06⅛
Beaver Con.	.40
Chambers Ferland	.12
Coniagas	4.00
La Rose	.53
Peterson Lake	.12
Right of Way	.04
T. & Hudson Bay	43.00
Temiskaming	.51
Wettlaufer-Lor.	.07⅛
Dome Exten.	.26
Dome Lake	.18
Foley O'Brien	.70
Hollinger	5.20
Jupiter	.31
McIntyre	1.88
Newray	1.33
Porcu. Crown	.63⅛
Schumacher	.58⅛
Vipond	.44
West Dome	.28

STOCK QUOTATIONS—Continued

COLO. SPRINGS	Mar. 27
Cresson Con.	6.00
Doctor Jack Pot	‡.07
Elkton Con.	.10⅛
El Paso	.20
Gold Sovereign	.04
Golden Cycle	2.28⅛
Granite	.55
Isabella	.18⅛
Mary McKinney	.23
Portland	1.70
United Gold M.	.16
Vindicator	.79

LONDON	Mar. 10		
Alaska Mexican	£0	12s	6d
Alaska Tre'dwell	2	10	0
Burma Corp.	3	16	3
Cam & Motor	0	8	9
Camp Bird	0	5	0
El Oro	0	7	3
Esperanza	0	7	9
Mexico Mines	4	10	0
Nechi, pfd.	0	12	6
Oroville	0	15	0
Santa Ger t'dis	0	8	9
Tomboy	1	0	0

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1915	1916	1917	1915	1916	1917
January	48.855	56.775	75.630	22.731	26.960	36.682
February	48.477	56.755	77.585	22.753	26.975	37.742
March	50.241	57.935		23.708	27.597	
April	50.250	64.415		23.709	30.662	
May	49.915	74.269		23.570	35.477	
June	49.034	65.024		23.267	31.060	
July	47.519	62.940		22.597	30.000	
August	47.163	66.083		22.780	31.498	
September	48.680	68.515		23.591	32.584	
October	49.385	67.855		23.925	32.361	
November	51.714	71.604		25.094	34.192	
December	54.971	75.765		26.373	36.410	
Year	49.684	65.661		23.675	31.315	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1916	1917	1916	1917	1916	1917
Jan.	24.008	28.673	88.083	131.921	116.167	142.895
Feb.	26.440	31.750	102.667	137.895	133.167	148.100
Mar.	26.310		107.714		136.000	
April	27.895		124.319		137.389	
May	28.625		135.457		150.522	
June	26.601		112.432		137.455	
July	23.865		95.119		125.500	
Aug.	26.120		110.283		126.304	
Sept.	26.855		113.905		134.071	
Oct.	27.193		122.750		142.523	
Nov.	30.625		134.659		155.432	
Dec.	31.890		145.316		162.842	
Year	27.202		116.059		138.281	

Tin	New York		London	
	1916	1917	1916	1917
January	41.825	44.175	175.548	185.813
February	42.717	51.420	181.107	198.974
March	50.741		193.609	
March	51.230		199.736	
May	49.125		196.511	
June	42.231		179.466	
July	38.510		168.357	
August	38.565		169.870	
September	38.830		171.345	
October	41.241		179.307	
November	44.109		186.932	
December	42.635		183.368	
Av. year	43.480		182.096	

Lead	New York		St. Louis		London	
	1916	1917	1916	1917	1916	1917
January	5.921	7.626	5.826	7.530	31.167	30.500
February	6.246	8.636	6.164	8.595	31.988	30.500
March	7.136		7.375		34.440	
April	7.630		7.655		34.368	
May	7.463		7.332		32.967	
June	6.936		6.749		31.011	
July	6.352		6.185		28.137	
August	6.244		6.088		29.734	
September	6.810		6.699		30.786	
October	7.000		6.898		30.716	
November	7.042		6.945		30.500	
December	7.513		7.405		30.500	
Year	6.858		6.777		31.359	

Spelter	New York		St. Louis		London	
	1916	1917	1916	1917	1916	1917
Jan.	16.915	9.619	16.745	9.449	89.810	48.329
Feb	18.420	10.045	18.260	9.875	97.762	47.000
Mar	16.846		16.676		95.048	
April	16.695		16.525		99.056	
May	14.276		14.106		94.217	
June	11.752		11.582		68.591	
July	8.925		8.755		50.750	
Aug	8.730		8.560		51.587	
Sept	8.990		8.820		52.095	
Oct	9.829		9.659		54.159	
Nov	11.592		11.422		56.023	
Dec	10.665		10.495		55.842	
Year	12.804		12.634		72.071	

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton. ‡ Not reported.

Pig Iron, Pitts.	Bessemer‡		Basic‡		No. 2 Foundry	
	1916	1917	1916	1917	1916	1917
January	$21.60	$35.95	$18.78	$30.95	$19.70	$30.95
February	21.16	36.37	18.93	30.95	19.51	30.95
March	21.81		19.20		19.45	
April	21.65		18.95		19.45	
May	21.78		19.11		19.58	
June	21.95		18.95		19.34	
July	21.95		18.95		19.20	
August	21.95		18.95		19.22	
September	22.88		19.58		19.53	
October	24.61		21.26		21.51	
November	30.07		28.18		26.55	
December	35.16		30.95		30.79	
Year	$23.88		$20.98		$21.15	

‡ As reported by W. P. Snyder & Co.